DASH 10

Operations Manual

Astro-Med, Inc.

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_06267

DASH 10 Operations Manual

part number 22834-310

2/95

Specifications are subject to change without notice.

Astro-Med, Inc.
600 East Greenwich Avenue
West Warwick, RI 02893
1-(401)-828-4000

---

technical support
1-800-343-4039

Copyright 1995 ©

This manual is copyrighted with all rights reserved. No part of this manual may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language in any form by any means without written permission of Astro-Med, Inc.

Limited Warranty

Astro-Med warrants all portions of the DASH 10 against defects in materials or workmanship for a period of one year from the date of original purchase. If you discover a defect, Astro-Med will, at its option, repair or replace this product at no additional charge except as set forth below. Repair parts and replacement parts will be furnished on an exchange basis and will be either reconditioned or new. All replaced parts become the property of Astro-Med.

This warranty does not apply if the product has been damaged by accident, abuse, misuse, or misapplication; or has been modified without the written permission of Astro-Med.

To obtain warranty services, call (401) 828-4000 for information. Astro-Med is not responsible for your product if it is lost or damaged in transit.

Astro-Med makes no warranty, either express or implied, with respect to this product's fitness for a particular purpose.

Recorder Identification Data

Congratulations. Your Astro-Med purchase is an investment in the finest of state-of-the-art chart recorder technology. Please use the spaces below to list the model number, serial number, and software version number of your chart recorder. The software provided with your DASH 10 is the most current available. Any upgrades of the chart recorder's system software should be noted in the space provided.

If, for any reason, it should be necessary for you to contact Astro-Med regarding your purchase, please refer to the following:

model number _____

serial number _____

software version
(original installation) _____

upgraded software version
(date installed) _____

upgraded software version
(date installed) _____

upgraded software version
(date installed) _____

FCC Compliance Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Shielded cables must be used with this unit to ensure compliance with the Class A FCC limits.

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canadian Emissions Requirements

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la class A prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

Declaration of Conformity
Declaration de Conformité
Ubereinstimmungserklärung
Dichiarazione di Conformità

Application of Council Directives Application des Decisiõns du Conseil Anwendbar für die Richtlinien Applicazione delle Direttive del Comitato	89/336/EEC 73/23/EEC

Standards to which conformity is declared Standards auquel la conformité appartient Normen für welche Übereinstimmung erklärt wird Norme per le quali si dichiara la conformità	IEC 348 IEC 801-2 IEC 801-3	IEC 801-4 EN 55011, Class A EN50082-1:1992

Manufacturer's name Nom du fabricant Hersteller Nome del costruttore	Astro-Med, Inc.	Model no. Modèle N° Model Nr. Modello N.°	DASH 10

Manufacturer's address Adresse du fabricant Anschrift des herstellers Indirizzo del costruttore	600 E. Greenwich Ave. West Warwick, RI 02893 USA	Serial no. N °de série Serien Nr. N.° di serie	_____

Type of equipment Type d'equipement Beschreibung des Gerates Tipo di apparecchio	printer / plotter	year of manufacture année de fabrication herstellungsjahr anno di costruzione	_____

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive and Standard.

Je, Soussigné, déclare que l'équipment spécifié ci-dessus est en conformité avec la directive et le standard ci-dessus.

Ich, der unterzeichnende erklâre hiermit, daß das oben beschriebene Gerät den vorgenannten Richtlinien und Normen entspricht.

Il sottoscritto dichiara che l'apparecchio sopra specificato è conforme alle Direttive e Norme.

Table of Contents

Quick Start

QS	To begin real-time recording	Quick Start-1

1 Description and specifications

1.1	Basic system specifications	1-1

2 Hardware features

2.1	Front-panel features	2-1
2.2	Rear-panel features	2-3
2.2.1	Rear-panel connection pin tables	2-4

3 Speed controls

3.1	Controlling the DASH 10's chart speed	3-1
3.1.1	Using the six fixed-speed keys to select a chart speed	3-1
3.1.2	Using the insta-speed keys to select a chart speed	3-2
3.1.3	Programming the insta-speed keys	3-3
3.1.4	Setting the chart speed using the [SPD] key	3-4
3.1.5	Setting the chart speed for data logger recording	3-5
3.2	Referencing the DASH 10 to an external motor-clock source	3-6

Table of Contents

4 Setting up a custom grid

4.1	Accessing the grid setups	4-1
4.2	The "MODIFY CHART" setups	4-1
4.2.1	CHANGE GRID: specifying a grid's layout and location on the chart	4-4
4.2.1.1	CHANGE GRID: synchronizing the grid to trilevel timing marks	4-8
4.2.2	CHANGE WAVE: suppressing or enabling the printing of waveforms	4-9
4.2.2.1	CHANGE WAVE: enabling or suppressing signal conditioner reporting	4-10
4.2.2.2	CHANGE WAVE: thickening the appearance of the recorded waveform	4-11
4.2.3	CHANGE EVENTS: enabling event markers; selecting their chart locations	4-13
4.2.3.1	CHANGE EVENTS: selecting a global event marker style	4-14
4.2.3.2	CHANGE NAMES: editing/creating a name for a stored recording format	4-16
4.2.4	DEFAULT TEXT: printing default text in annotation buffers	4-17
4.2.5	DEFAULT CHARTS: selecting a default chart layout	4-18

5 Adding text to the chart

5.1	Adding text to the chart	5-1
5.1.1	Enabling or suppressing printing of text buffers	5-2
5.1.2	Editing text buffers	5-2
5.1.3	Positioning a text buffer on the chart	5-4
5.1.4	Printing the on-demand text buffer	5-5
5.2	Printing channel ID numbers	5-6

Table of Contents

6 Recorder sensitivity and signal adjustment

6.1	Chart sensitivity in the DASH 10	6-1
6.2	DASH 10 zero and gain controls	6-2
6.2.1	Setting a selected channel's voltage range	6-4
6.2.2	Selecting either the peak-to-peak or RMS recording mode	6-5
6.2.3	Grounding individual waveform channels	6-6
6.2.4	Positioning a waveform's zero baseline	6-7
6.2.5	Applying zero suppression to waveform signals	6-9
6.2.6	Using the recorder's low-pass filter	6-10
6.2.7	Converting voltage data to engineering units for numeric reporting	6-10
6.2.8	Calibrating individual channels with the DASH 10's built-in precision voltage references	6-13
6.2.9	Using MASTER CHANNEL to change all analog settings	6-15

7 Setting up and enabling triggers

7.1	DASH 10 triggering capabilities	7-1
7.1.1	Turning on MANUAL, HOST, and EXTERNAL trigger sources	7-3
7.1.2	Combining waveform trigger sources into trigger groups	7-4
7.1.3	Setting trigger reference values	7-8
7.1.4	Setting up a periodic trigger	7-11

Table of Contents

8 Data capture

8.1	About capturing data with the DASH 10	8-1
8.2	About data-capture memory	8-3
8.3	Data-capture setups	8-5
8.3.1	Selecting a data-capture sample rate	8-8
8.3.2	Selecting a data capture record size	8-10
8.3.3	The data-capture window and trigger placement	8-11
8.3.4	Selecting a data-capture method	8-14
8.3.5	Linking multiple data-capture boards	8-19
8.3.6	Data-capture record naming conventions	8-21
8.3.7	Archiving data-capture records to diskette	8-22
8.3.8	Deleting data-capture records from data-capture memory	8-28
8.3.9	Restoring data-capture records from diskette to data-capture memory	8-30

9 Data playback

9.1	Playing back data with the DASH 10	9-1
9.1.1	Selecting a data-capture record for playback	9-4
9.1.2	Selecting either the entire record or a specific part of the record for playback	9-5
9.1.3	Expanding or compressing a playback	9-9
9.1.4	Selecting a chart format for the playback	9-11
9.1.5	Setting up an XY plot	9-14
9.1.6	Selecting a destination for the playback	9-17
9.1.7	Running the playback	9-18
9.2	Plotting a data-capture record as a fast Fourier transform (FFT)	9-20
9.2.1	Plotting the waveform input to select data for an FFT	9-22
9.2.2	Performing Fourier analysis on selected data	9-25

Table of Contents

10 Diskette-based input/output

10.1	Input/output functions when using diskettes	10-1
10.2	About the settings that make a recorder setup	10-3
10.3	Saving a recorder setup to diskette	10-4
10.4	Recalling a recorder setup from diskette	10-5
10.5	Renaming files on diskette	10-7
10.6	Deleting files from diskette	10-9
10.7	Formatting diskettes	10-10
10.8	Printing ASCII files from diskette	10-11

11 System input/output

11.1	DASH 10 system input/output	11-1
11.2	Setting the system clock	11-3
11.3	Setting up the RS232 interface	11-4
11.4	Setting up the GPIB interface	11-5
11.5	Performing a system software upgrade	11-6

12 Dual speed recording

12.1	Timed and triggered dual speed recording	12-1
12.2	Setting up timed dual-speed recording	12-1
12.3	Setting up triggered dual-speed recording	12-7

13 Using the TIMED START recording mode

13.1	Setting up the TIMER START recording mode	13-1
13.2	Starting immediate recording in the TIMER START mode	13-4

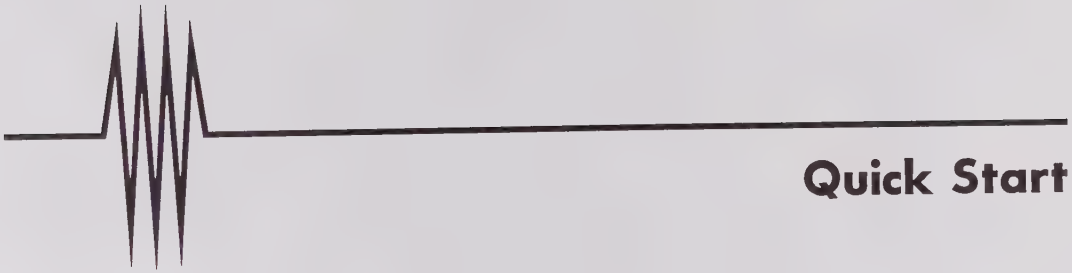
Table of Contents

14 Miscellaneous recorder functions

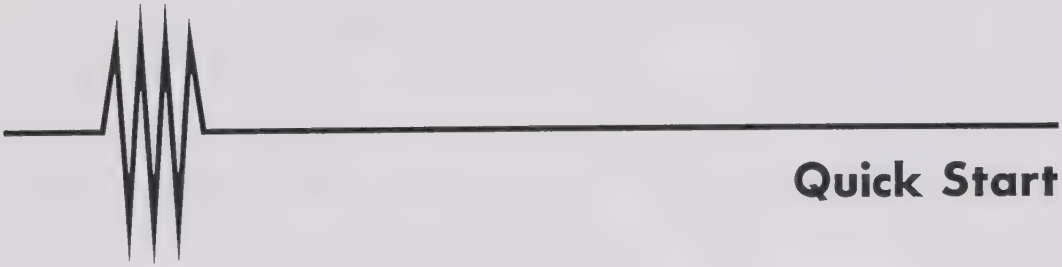
14.1	Miscellaneous recorder functions	14-1
14.2	Using the [HELP] key	14-1
14.3	Using the [EVNT] key	14-11
14.4	Using the [RUN/HALT] key and the [FEED] key	14-11
14.5	Using the TOP-OF-FORM capability	14-12
14.6	Using the PAGE EJECT function	14-12
14.7	DASH 10 error messages	14-13

15 Maintenance

15.1	Maintenance procedures	15-1
15.2	Changing the fuses / line-voltage setting	15-1
15.3	Cleaning the printhead	15-3
15.4	Replacing or adjusting the printhead	15-5
15.5	Replacing a battery pack	15-11



Quick Start



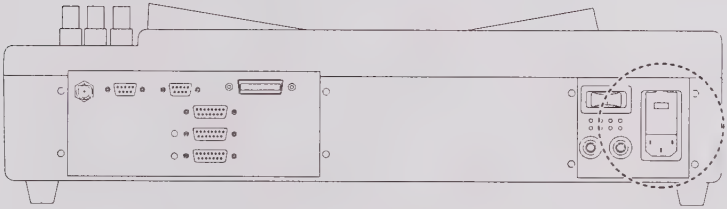
Quick Start

To begin real-time recording

This Quick Start section provides a brief procedure for setting up and beginning recording with your DASH 10. The Quick Start procedure assumes that you have unpacked your DASH 10 and have removed and noted the standard accessories provided with the recorder.

1 **Examine the DASH 10 and verify that the recorder has not been damaged during shipment.**

2 **Locate the fuse block / voltage selection box on the recorder's rear panel.**



3 **Verify that the recorder is set to the voltage that you will be using.**

- **View the voltage selection cylinder through the window on the fuse block / voltage selection box.**

120VAC

240VAC

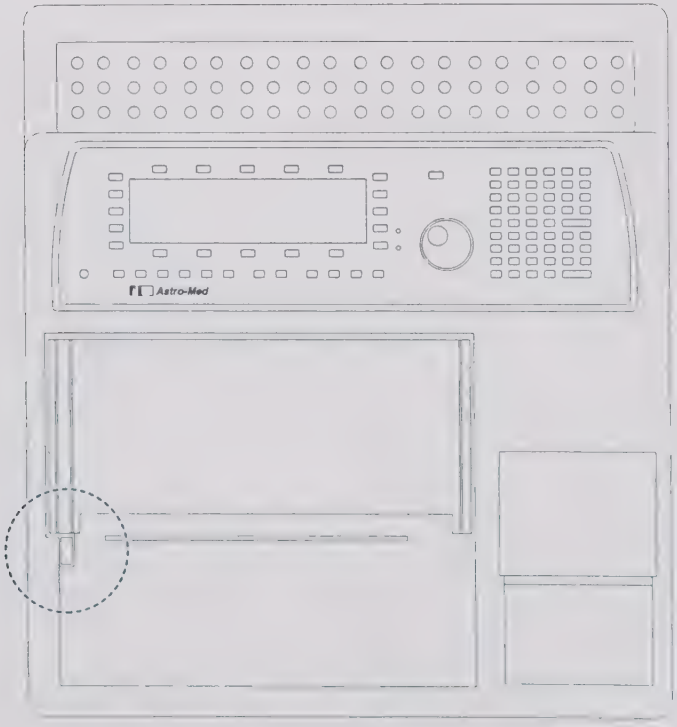
To begin real-time recording

4 Connect the AC power cord to the DASH 10's rear panel.

5 With the recorder turned off, plug the AC power cord into a power outlet.

6 Locate the roll thermal paper supplied with your DASH 10.

7 Open the paper-chamber door by pressing the paper-chamber door release.

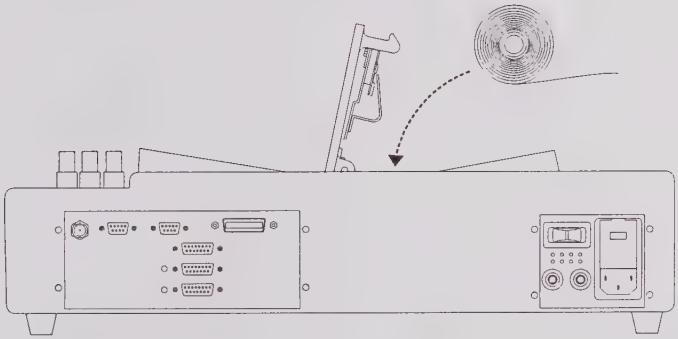


To begin real-time recording

8 As shown in the illustration below, place a roll of thermal paper into the paper chamber.

- Ensure that the thermal paper is inserted so that it unwinds from the bottom of the roll.
- Allow a few inches of paper to extend out of the chamber.

9 Close the paper-chamber door.



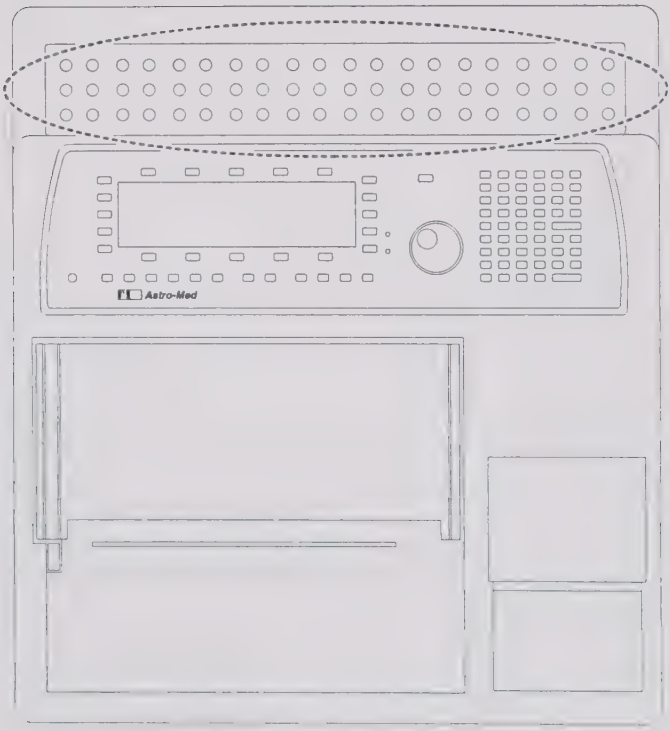
10 Plug the recorder in and turn it on.

11 Locate your guarded binding post or banana jack signal input connectors.

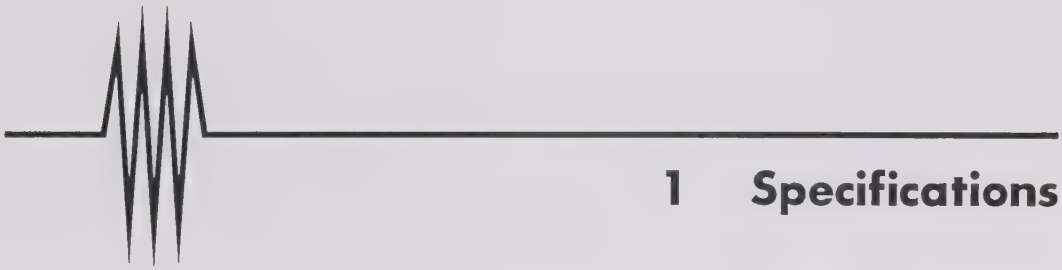
- Signal input connectors are not supplied with your DASH 10. You must supply the signal input connectors.

To begin real-time recording

12 Using your guarded binding post or banana jack connectors, bring your signals into the recorder at the front panel input connections.



1 Specifications



1 Specifications

Basic system specifications

recording method	direct thermal
frequency response	DC to 25 kHz (-3 dB)
RMS bandwidth	50 kHz
analog waveform channels	10, 20, or 30
amplitude resolution	12 dpm (300 dots per inch)
time base resolution	■ 12 dots per mm (dpm) for 1 to 100 mm/sec ■ 6 dots per mm (dpm) for 101 to 200 mm/sec
event channels	■ 1 per waveform channel ■ 1 system event ■ 2 timer events
chart width	280 mm (11")
maximum waveform size	256 mm
grid sizes	30 independent grids up to 250 mm wide can be placed anywhere on the chart
speeds	1 mm/min to 200 mm/sec
speed accuracy	±2%
paper capacity	48 m per roll

Basic system specifications

input type	isolated, single-ended voltage amplifier
user input connector	guarded binding posts
input coupling	DC
range	50 mV to 500 V full scale
maximum differential input	500 V peak or 250 V RMS
maximum CMV (IMV)	500VDC
input impedance	1 Megohm
zero suppression	■ ±5V (2.5 mV step) for ranges <5V ■ ±500V (.25 V step) for ranges ≥5 V
zero suppression error	±2%
sample rate	250 kSamples/sec
RMS	handle crest factors to 8 with < 1% error
CMRR at 60 Hz	>80 dB
low pass filter	10 Hz
maximum intrinsic noise	1 mm
non-linearity	<0.1% of full scale
baseline drift with time	1% of full scale
baseline drift with temperature	<0.1% of full scale per °C

Basic system specifications

monitor type	built-in vacuum fluorescent display for both text and real-time waveforms
monitor resolution	256 dots (w) x 64 dots (h)
waveform format	waterfall scroll
monitor refresh rate	100 Hz
alphanumeric keypad	full alphanumeric keypad for annotation entry
encoder wheel	used for rapid entry of gain/zero position, chart layout, and many other recording parameters
chart speed keys	■ quick keys for 1, 5, 25, 50, 100, and 200 mm/sec or mm/min ■ 3 user-defined speed keys
indicators	battery status, arm, trigger
host interfaces	■ GPIB ■ RS232 (DTR/DSR and XON/XOFF)
disk drive	1.44 MByte, DOS compatible, 3.5" floppy drive for saving setups and annotation, archiving data, and upgrading software
remote start / stop	standard via switch closure or TTL
standard real-time recording	10 to 30 channels with annotation buffers in overlap and separate channel modes
user-defined formats	■ user can design unique charts using standard menus ■ maximum of 20 formats can be saved to floppy disk for quick chart setups

Basic system specifications

data logger	■ numeric reporting of waveform data in engineering units ■ 5 Hz maximum sample rate
timed recording	system can be programmed to start and stop recording at specific times
line print	125 columns
A/D converters	each channel has own A/D converter
ADC resolution	12 bits
annotation units	all annotation can be selected in either voltage or user-defined engineering units
system log	single line containing the time, date, chart speed, and time mark setting
channel annotation	each channel has a 128-character ASCII buffer printed at any user-specified chart location
signal conditioner annotation	if enabled, uses last 32 characters of channel annotation
on-demand annotation	128-character buffer printed anywhere on the chart
channel ID	■ each channel is labeled with channel number on demand ■ full scale top and bottom values of the grid can be printed in either voltage or engineering units

Basic system specifications

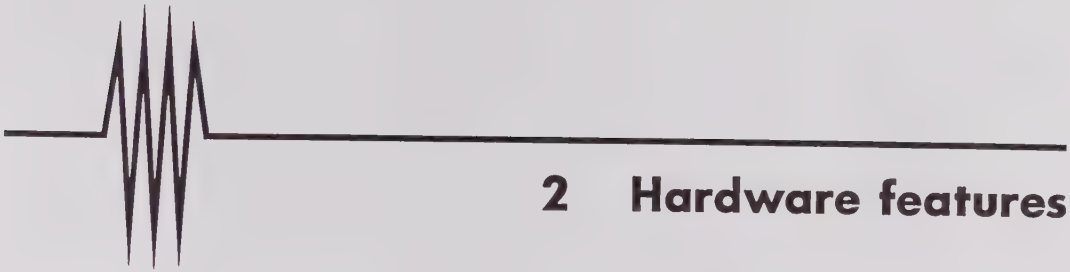
tri-state timing marks	x1, x10, x100 mark on left, right, or both edges
horizontal grid lines	may be synchronized to time mark
time mark intervals	0.01 - 0.09, 0.10 - 0.90, 1 - 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60
manual event mark	■ front-panel key or external TTL / switch closure ■ choice of bar on/off or binary level
external event marks	maximum of 30 event marks available (TTL or switch closure), non-isolated, glitch capture
power options	standard AC, DC, or optional internal battery
AC requirement	120/240 VAC nominal at 50 or 60 Hz
DC requirement	11-18 VDC
operating temperature	0°C to 40°C
storage temperature	-20°C to 80°C
relative humidity	0% to 95%, non-condensing

Basic system specifications

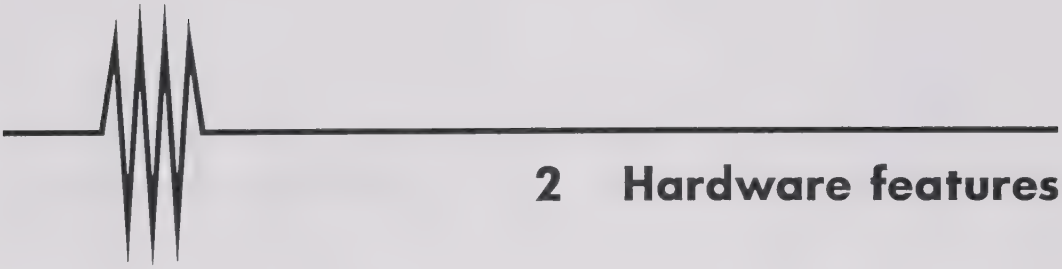
overall dimensions	height: 5" (127 mm) depth: 20" (508 mm) width: 18" (457 mm)
weight	■ 36 lbs (16 kg) with battery ■ 32 lbs (15 kg) without battery (10 channel)
data capture	■ each channel can capture a maximum of 558 kSamples of data to RAM during one capture ■ captures can be stacked in 69 kSample blocks or memory can be linked for a total of 6 megasamples per ten channels ■ events are also captured
background capture	standard
capture memory	DRAM
capture time stamping	all records are time stamped at end of capture
capture sample rates	5 to 250 kSamples per second per channel
capture record sizes	■ 69 kSamples/channel (stacked) ■ 558 kSamples/channel (not stacked or linked) ■ 6 megasamples (linked, 1 channel capture per 10 channels)
capture stacking	■ maximum of 8 records can be stacked ■ stack a maximum of eight 69 kSample blocks per channel

Basic system specifications

capture header	each record contains complete capture information including analog settings
manual trigger	with front-panel key
host trigger	RS232 or GPIB
periodic trigger	user programmed, internal
waveform trigger	inside window, outside window, AND/OR combinations
battery	■ fits internal DASH 10 compartment and charges automatically whenever unit is connected to external power. ■ ideal for field use and in the lab as a UPS
battery life	1 hour, nominal
battery charge time	15 hours

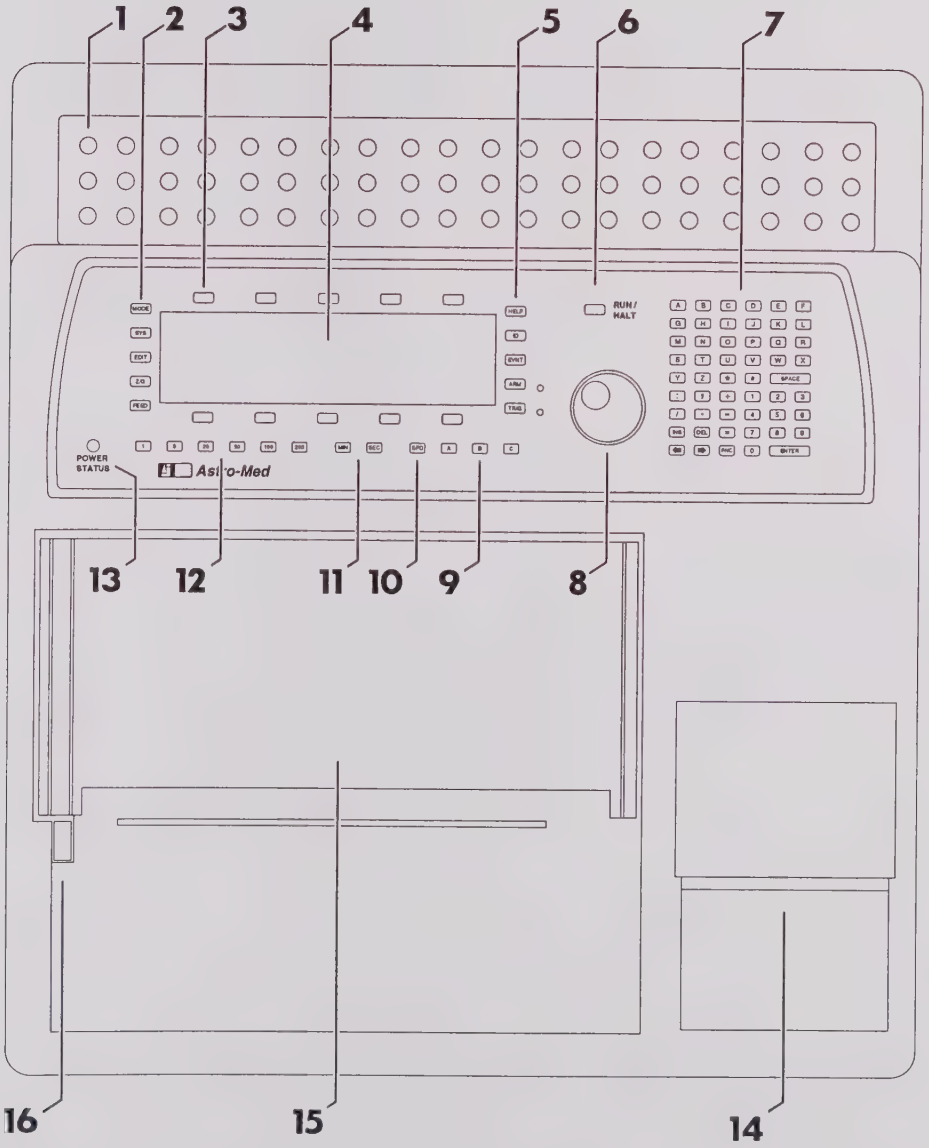


2 Hardware features



2 Hardware features

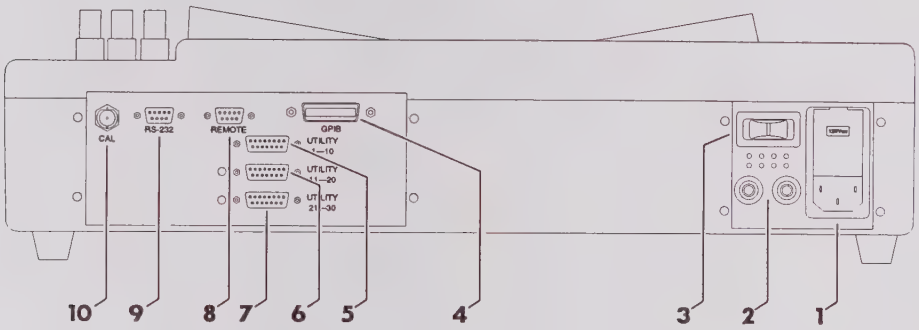
Front-panel features



Front-panel features

callout	description
1	guarded binding post signal inputs
2	left-side control group: • [MODE] key • [SYS] key • [EDIT] key • [Z/G] key • [FEED] key
3	upper and lower soft keys
4	vacuum fluorescent display
5	right-side control group: • [HELP] keys • [ID] keys • [EVENT] keys • [ARM] keys • [TRIG] keys
6	[RUN/HALT] key
7	alphanumeric keypad
8	encoder wheel
9	[A], [B], [C] insta-speed keys
10	custom-speed key
11	speed range keys
12	fixed-speed selection keys
13	POWER STATUS indicator
14	disk drive
15	paper-chamber door
16	paper-chamber door release

Rear-panel features



callout	description
1	AC power input connector
2	DC input connectors
3	power on/off switch
4	GPIB D-shell connector
5	UTILITY D-shell connector for signal inputs 1 - 10
6	UTILITY D-shell connector for signal inputs 11 - 20
7	UTILITY D-shell connector for signal inputs 21 - 30
8	REMOTE D-shell connector
9	RS-232 D-shell connector
10	calibration connector (2.5V/10V out) Do not use.

Rear-panel connection pin tables

RS232 D-SHELL CONNECTOR

pin	description
1	not used
2	TXD
3	RXD
4	DSR
5	ground
6	DTR
7	internally connected
8	internally connected
9	not used

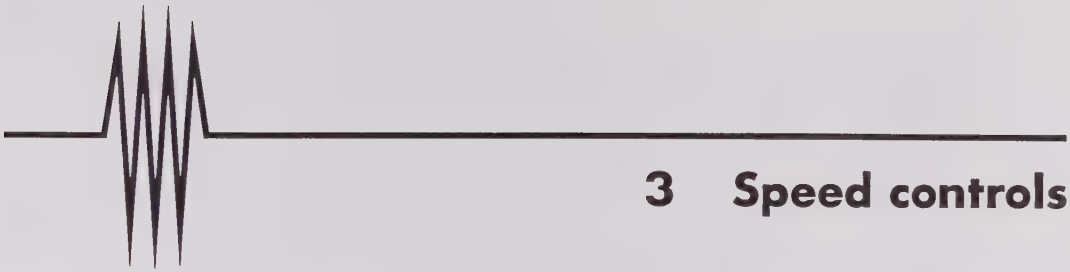
REMOTE D-SHELL CONNECTOR

pin	description
1	external motor clock input
2	system event
3	trigger out
4	arm
5	ground
6	remote start/stop
7	trigger in
8	print on-demand buffer
9	not used

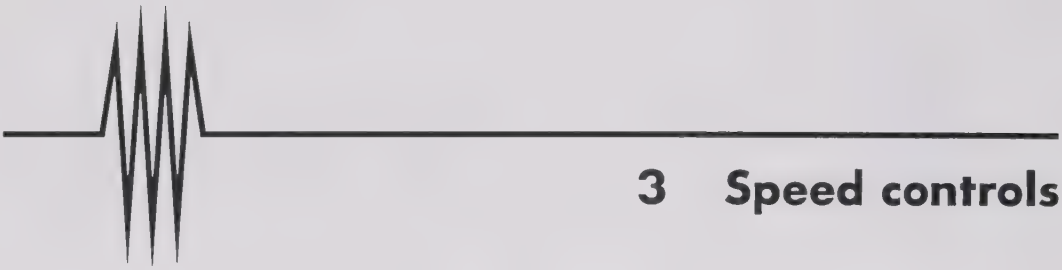
Rear-panel connection pin tables

UTILITY PORT D-SHELL CONNECTOR

pin	description
1	event 1
2	event 2
3	event 3
4	event 4
5	event 5
6	event 6
7	event 7
8	event 8
9	event 9
10	event 10
11	ground
12	ground
13	ground
14	ground
15	ground



3 Speed controls



3 Speed controls

3.1

Controlling the DASH 10's chart speed

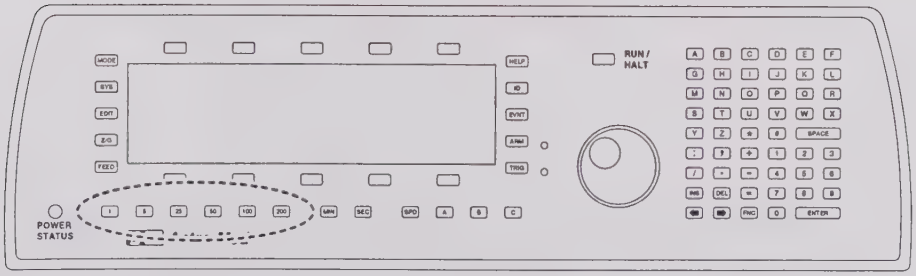
The DASH 10 provides you with unmatched versatility in controlling the real-time speed of the chart.

- six front-panel keys allow you to instantly select chart speeds of 1, 5, 25, 50, 100, and 200 mm/second or mm/minute.
- three front-panel insta-speed keys labeled [A], [B], and [C] are programmable to provide three instantly available chart speeds of your choice.
- a front-panel [SPD] (speed) key permits you to program the chart speed of your choice within the DASH 10's operational limits.

3.1.1

Using the six fixed-speed keys to select a chart speed

The six front-panel fixed-speed keys are the simplest way to control the DASH 10's real-time chart speed. Press the key of your choice to have the recorder instantly operate at that speed in mm/sec or mm/min.



3.1.1

Using the six fixed-speed keys to select a chart speed

Press the fixed-speed key of your choice to instantly select that chart speed in millimeters per second or millimeters per minute.

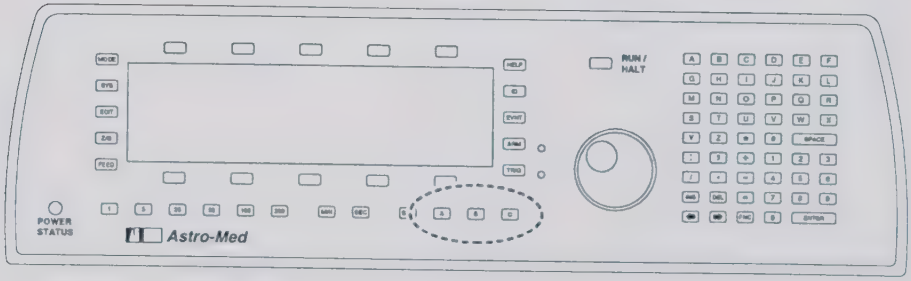
- [1] selects a speed of 1 mm/sec or mm/min.
- [5] selects a speed of 5 mm/sec or mm/min.
- [25] selects a speed of 25 mm/sec or mm/min.
- [50] selects a speed of 50 mm/sec or mm/min.
- [100] selects a speed of 100 mm/sec or mm/min.
- [200] selects a speed of 200 mm/sec or mm/min.

3.1.2

Using the insta-speed keys to select a chart speed

If they have not been programmed to provide other chart speeds, the [A], [B], [C] insta-speed keys will provide the following factory-default speeds instantly when they are pressed:

- [A] 10 mm/sec
- [B] 75 mm/sec
- [C] 150 mm/sec



Programming the insta-speed keys

The [A], [B], [C] insta-speed keys can be programmed to provide any chart speed within the operational range of the DASH 10. Use the procedure below to program the insta-speed keys to the specific speeds your recording requires.

1 **Press the front-panel [SPD] key.**

2 **Press the soft key beneath "INSTA SPEED."**

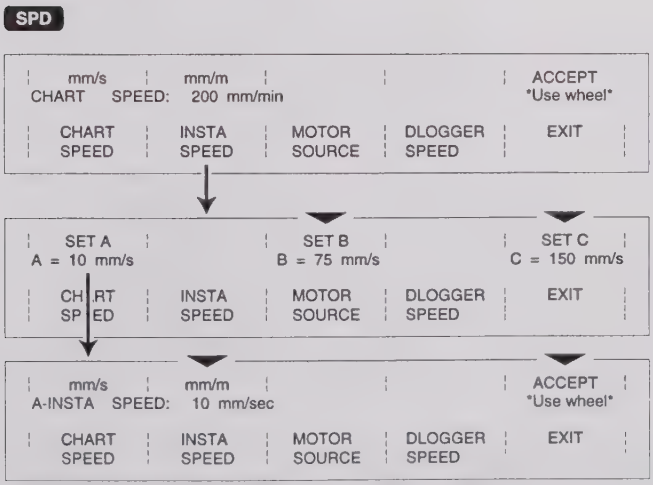
3 **Press the soft key above "SET A" to set the insta-speed for [A].**

4 **Press the soft key above the speed range that you want:**

- **mm/s: millimeters per second**
- **mm/m: millimeters per minute**

5 **Use the encoder wheel to select the chart speed that you want to program into insta-speed key [A].**

- **In the mm/s speed range, the available speeds are 1 mm/s to 200 mm/s in 1mm/s intervals.**
- **In the mm/m speed range, the available speeds are 1 mm/m to 200 mm/m in 1 mm/m intervals.**



3.1.3

Programming the insta-speed keys

6 Press the soft key above "ACCEPT" to confirm the speed choice.

7 Repeat steps 3 through 6 to program insta-speed keys [B] and [C].

3.1.4

Setting the chart speed using the [SPD] key

1 Press the front-panel [SPD] key.

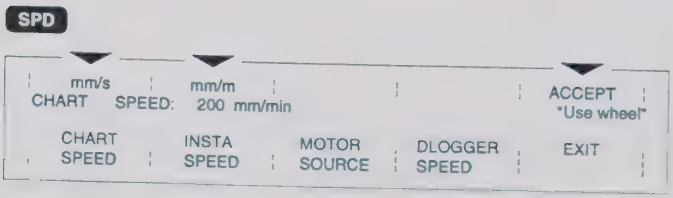
2 Press the soft key above the speed range that you want:

- mm/s: millimeters per second
- mm/m: millimeters per minute

3 Use the encoder wheel to select the chart speed that you want.

- In the mm/s speed range, the available speeds are 1 mm/s to 200 mm/s in 1mm/s intervals.
- In the mm/m speed range, the available speeds are 1 mm/m to 200 mm/m in 1 mm/m intervals.

4 Press the soft key above "ACCEPT" to confirm the speed choice.



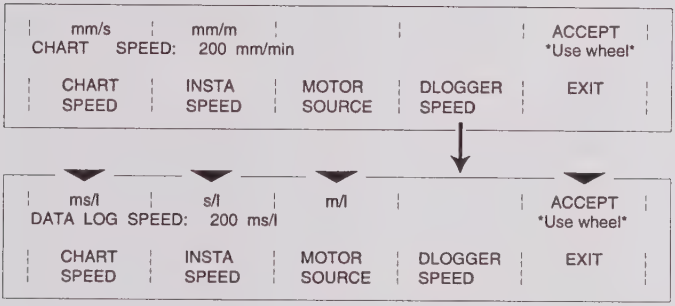
Setting the chart speed for data logger recording

1 Press the front-panel [SPD] key.

2 Press the soft key below "DLOGGER SPEED."

- If the active chart format is Data logger, pressing the [SPD] key automatically places you into the "DLOGGER SPEED" menu.

SPD



3 Press the soft key above the speed range you want:

- ms/l: milliseconds per line
- s/l: seconds per line
- m/l: minutes per line

4 Use the encoder wheel to select the speed you want.

- In the ms/l speed range, the available speeds are 200 ms/l to 999 ms/l in 1 ms/l intervals.
- In the s/l speed range, the available speeds are 1 s/l to 999 s/l in 1 s/l intervals.
- In the m/l speed range, the available speeds are 1 m/l to 999 m/l in 1 m/l intervals.

5 Press the soft key above "ACCEPT" to confirm your speed selection.

Referencing the DASH 10 to an external motor-clock source

Typically, the print rate of the DASH 10's stepper motor is referenced to a dedicated internal clock specifically tasked with stepper-motor timing control. Under this internal control during real-time recording, the stepper motor moves the chart to a maximum rate of 12 steps per millimeter of distance on the chart.

For certain recording applications, it may be convenient to reference the speed of the stepper motor to an external motor-clock source that you supply. This is especially useful when you want the stepper motor speed to be controlled by a variable other than time. For instance, it might be more meaningful to monitor railroad measurements as functions of distance rather than time.

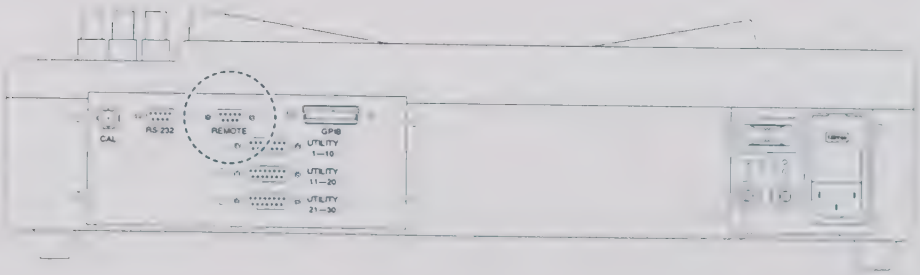
The maximum external motor clock frequency is 300Hz. This corresponds to a speed of 25 mm/s.

When you have configured an external stepper-motor timing source to be referenced in place of the DASH 10's internal clock, use the "MOTOR SOURCE" setup of the [SPD] key to enable the external timing source.

1 **Connect your input stepper-motor clock source to pin 1 of the rear-panel REMOTE D-shell.**

- **The complete pin table for the REMOTE D-shell is given on page 2-4.**

2 **Connect the associated ground to pin 12 of the REMOTE D-shell.**



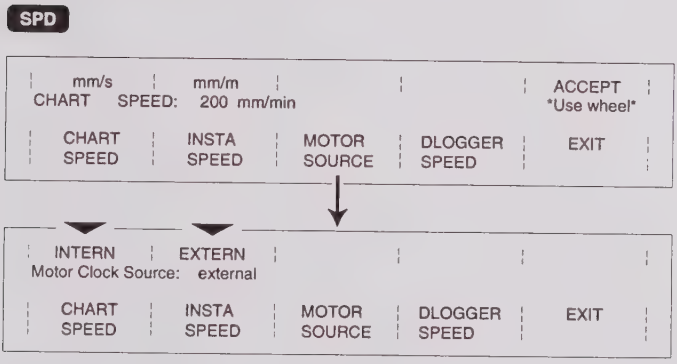
Referencing the DASH 10 to an external motor-clock source

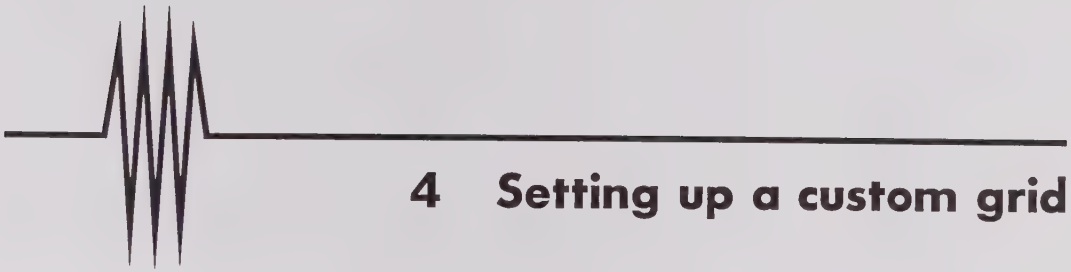
3 Press the front-panel [SPD] key.

4 Press the soft key below "MOTOR SOURCE."

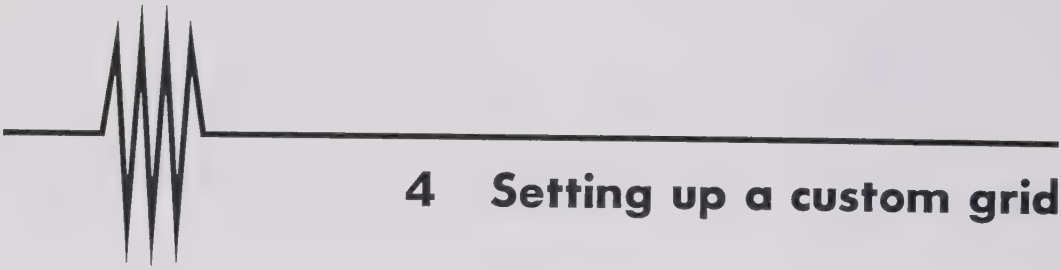
5 Press the soft key above "EXTERN."

- Note that the motor clock source selection shown in the display reads "external."





4 Setting up a custom grid



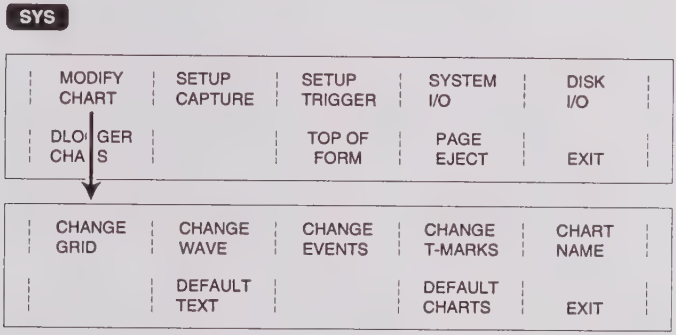
4 Setting up a custom grid

4.1

Accessing the grid setups

To setup a custom recording grid, each of the setups found under the "MODIFY CHART" parameter needs to be defined.

The "MODIFY CHART" setups are accessed by pressing the front-panel [SYS] key and then pressing the soft key above "MODIFY CHART."



4.2

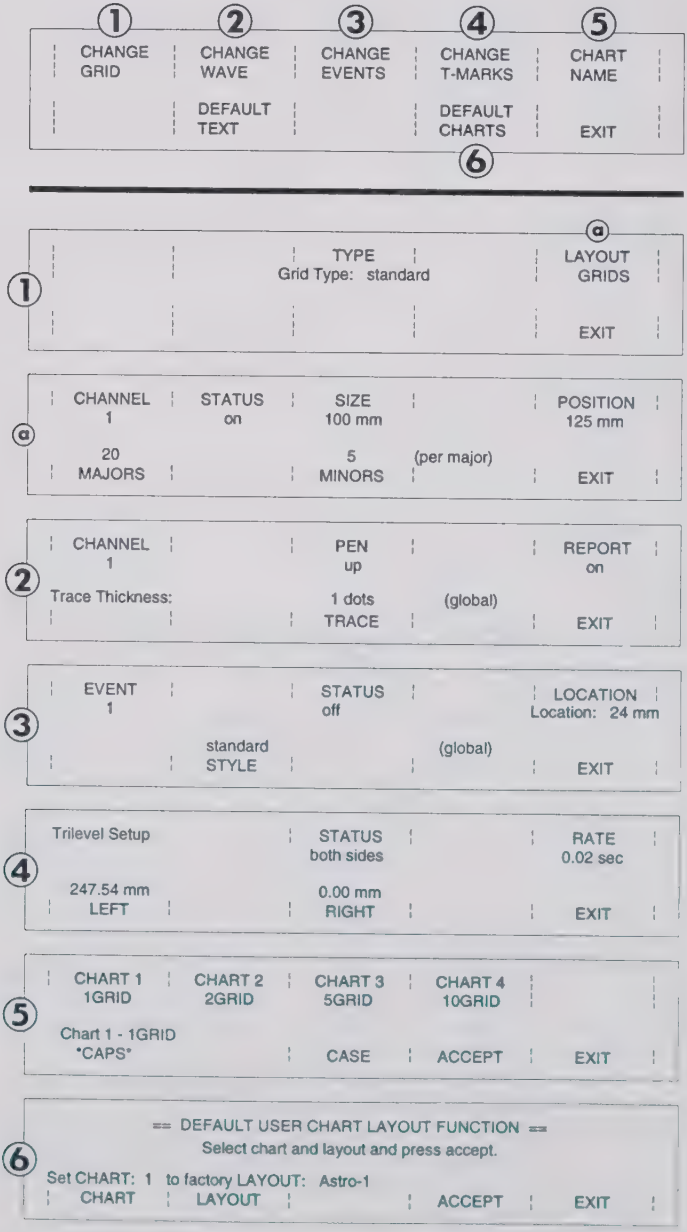
The "MODIFY CHART" setups

The complete menu flow of the "MODIFY CHART" parameter is shown on the next page.

The following chart format setups are found under the "MODIFY CHART" parameter:

- CHANGE GRID
  - synchronizes the time-axis grid lines to trilevel timing marks or prints the time-axis grid lines at the recorder's standard 5mm intervals.
  - turns printing of the grid on and off.
  - selects the size and location of the grid and the number of major and minor divisions the grid contains.

The "MODIFY CHART" setups



The "MODIFY CHART" setups

- selects the spacing in millimeters that you want between the grid's major and minor divisions.

- positions the grid on the chart.

■ CHANGE WAVE

- turns printing of the waveform on and off.

- enables or suppresses printing of signal conditioner reporting in the annotation buffer associated with the selected channel.

- thickens the recorded trace for enhanced visibility and reproducibility.

■ CHANGE EVENTS

- selects an event marker.

- turns printing of the event marker on or off.

- selects an event marker style that will apply to all of the recorder's event markers when they are printed.

- selects the location on the chart where the event marker will be printed.

■ CHANGE T-MARKS

- turns printing of timing marks on and off.

- selects the location of the timing marks on the chart: left edge, right edge, or both edges.

- selects the internal time reference that will serve as the base time that determines the duration represented between each timing mark tick.

4.2

The "MODIFY CHART" setups

- CHART NAME
  - allows the creation of an alphanumeric name for each of four user-definable recording modes to be stored in recorder memory.
- DEFAULT TEXT
  - causes all interchannel annotation buffers to print a default channel identification such as "CHANNEL 1."
- DEFAULT CHARTS
  - provides a selection of four default grid layouts to be used with one of four chart setups.

4.2.1

CHANGE GRID: specifying a grid's layout and location on the chart

The LAYOUT GRIDS selection of the CHANGE GRID parameter permits you to design exactly the grid you want by allowing you to specify:

- the number of major divisions your grid will contain.
- the number of minor divisions your grid will contain.
- the size of the grid in millimeters.
- the location of the right edge of the grid on the chart.

Use the following procedure to layout the grid that you want.

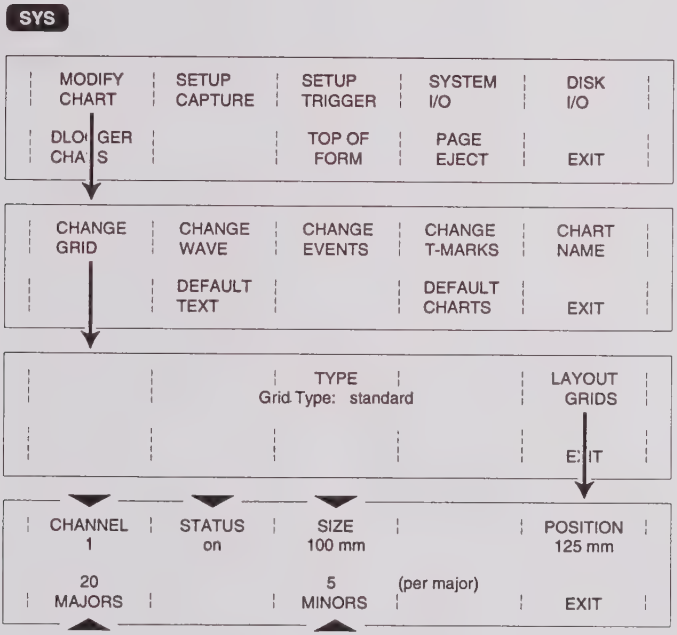
1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "MODIFY CHART."**

3 **Press the soft key above "CHANGE GRID."**

CHANGE GRID:
specifying a grid's layout and location on the chart

4 Press the soft key above "LAYOUT GRIDS."



5 Press the soft key above "CHANNEL."

6 Use the encoder wheel to select a channel for the grid.

7 Press the soft key below "MAJORS."

8 Use the encoder wheel to select the number of major divisions that you want the chart to contain.

- A chart can contain from 1 to 250 major divisions.

CHANGE GRID:
specifying a grid's layout and location on the chart

9 Press the soft key above "SIZE."

10 Use the encoder wheel to select the size of the grid in millimeters.

11 Press the soft key below "MINORS."

12 Use the encoder wheel to select the number of minor divisions you want each major chart division to contain.

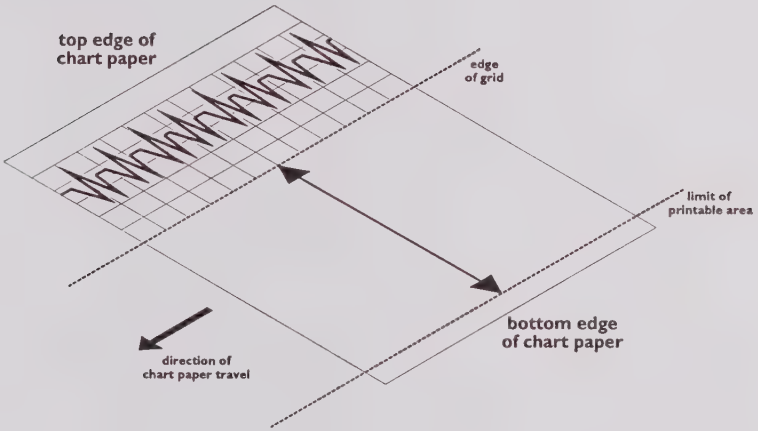
- The number of minor divisions can be from 1 to 250.

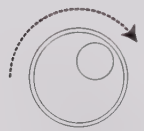
13 Press the soft key above "POSITION."

14 Use the encoder wheel to select a chart location for the right edge of your grid.

- The number of chart locations is from 1 to 250.
- Chart locations are measured across the chart from 1 mm near the bottom of the chart to 250 mm near the top of the chart.
- The right edge of your grid will move dynamically to each chart location as you turn the encoder wheel.

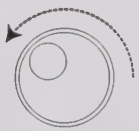
CHANGE GRID:
specifying a grid's layout and location on the chart





+ rotate right.

positive values
shift waveform
toward top of chart.



− rotate left.

negative values
shift waveform
toward bottom of chart.

CHANGE GRID:
synchronizing the grid to trilevel timing marks

The CHANGE GRID parameter allows you to select from two DASH 10 grid types: standard and t-based.

- "standard" grids are printed in standard 5mm increments and are not synchronized to the recorder's trilevel timing marks.
- "t-based" grids are time-based grids printed with divisions that are synchronized to the recorder's trilevel timing marks.

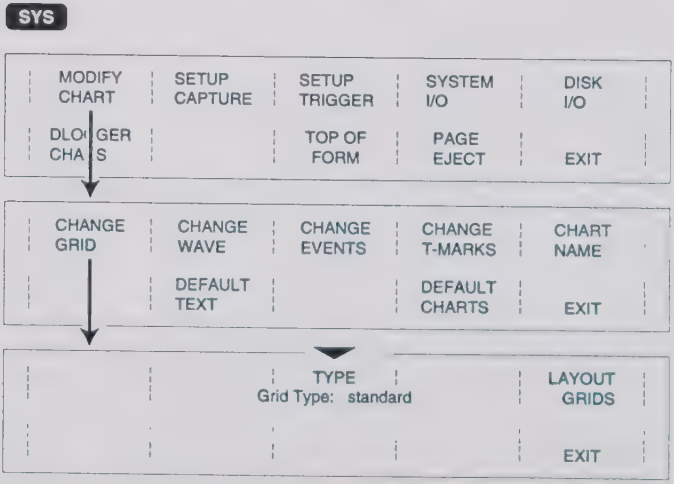
Use the procedure below to select the grid type that you want: unsynchronized (standard) or synchronized (t-based).

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "MODIFY CHART."**

3 **Press the soft key above "CHANGE GRID."**

4 **Press the soft keys above "TYPE" to select either the standard grid type or a t-based grid type.**



CHANGE WAVE:
suppressing or enabling the printing of waveforms

The waveforms printed by the DASH 10 can be individually selected and kept from printing to achieve an effect like the "pen up" condition of traditional pen-based recorders.

Use the procedure below to set individual channels to "PEN UP" to suppress printing of the selected waveform.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "MODIFY CHART."**

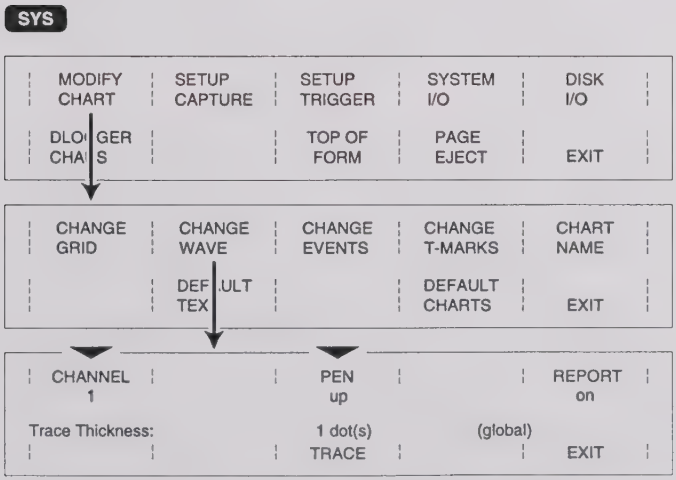
3 **Press the soft key above "CHANGE WAVE."**

4 **Press the soft key above "CHANNEL."**

5 **Use the encoder wheel to select the channel you want to suppress or enable.**

6 **Press the soft key above "PEN."**

- **When the menu reads "PEN up," the waveform will not be printed.**
- **When the menu reads "PEN down," the waveform will print.**



CHANGE WAVE:
enabling or suppressing signal conditioner reporting

The DASH 10 can print the gain and zero position settings associated with each channel in the channel's annotation buffer. This information is referred to as signal conditioner reporting. Generally, this information is printed in the last forty character spaces of the annotation buffer. Use the procedure below to turn signal conditioner reporting on or off.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "MODIFY CHART."**

3 **Press the soft key above "CHANGE WAVE."**

4 **Press the soft key above "CHANNEL."**

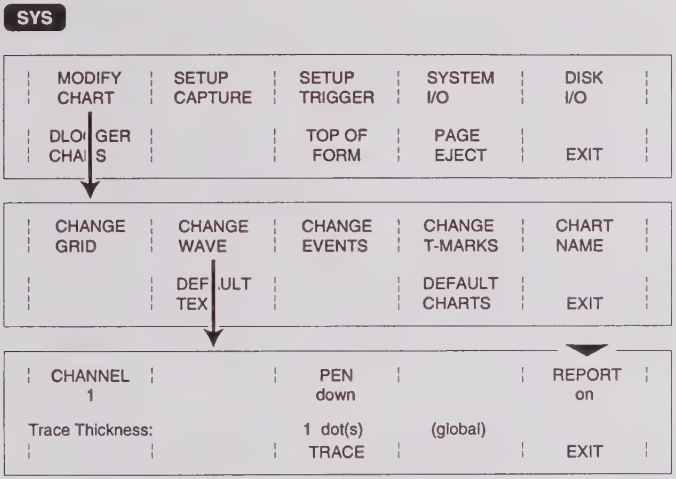
5 **Use the encoder wheel to select the channel of interest.**

6 **Press the soft key above "REPORT."**

- **When the menu reads "REPORT off," signal conditioner reporting will not be printed.**
- **When the menu reads "REPORT on," signal conditioner reporting will be printed.**
- **See the illustration at the top of the next page.**

4.2.2.1

CHANGE WAVE:
enabling or suppressing signal conditioner reporting



4.2.2.2

CHANGE WAVE:
thickening the appearance of the recorded waveform

The "TRACE" adjustment allows you to control the thickness of the line segments that make up the waveform recorded on the chart. With the "TRACE" adjustment, you can increase or decrease the thickness of the recorded waveform.

A basic use for this feature is to thicken the appearance of the recorded waveform to give it greater visibility on the chart and to improve the quality of copies made from the chart.

Use the procedure below to thicken the appearance of the waveform recorded on the chart paper.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "MODIFY CHART."**

CHANGE WAVE:
thickening the appearance of the recorded waveform

3 Press the soft key above "CHANGE WAVE."

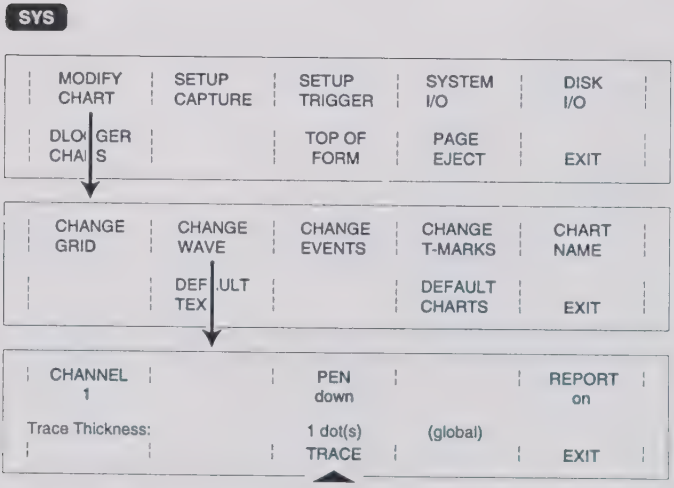
4 Press the soft key above "CHANNEL."

5 Use the encoder wheel to select the channel of interest.

6 Press the soft key below "TRACE."

7 Use the encoder wheel to select the amount of enhanced thickness you want added to the recorded waveform.

- Trace thickness can be enhanced by the addition of from 1 to 24 dots.



CHANGE EVENTS: enabling event markers; selecting their chart locations

In addition to its standard system event marker and two timer event markers, the DASH 10 can be equipped with a maximum of thirty external event markers. The CHANGE EVENTS parameter permits you to choose each event marker and:

- turn printing of the event marker on and off.
- position the event marker on the chart.
- select a global event marker style.

The procedure below describes how to enable an event marker and place the event marker at the chart location that you want. The procedure for selecting a global event-marker style is given in paragraph 4.2.3.1.

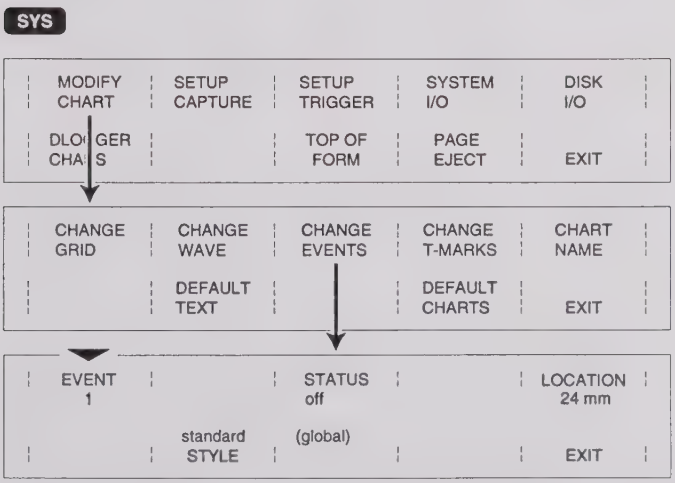
1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "MODIFY CHART."**

3 **Press the soft key above "CHANGE EVENTS."**

4 **Press the soft key above "EVENT."**

5 **Use the encoder wheel to select the event marker you want.**



CHANGE EVENTS:
enabling event markers; selecting their chart locations

6 Press the soft key above "STATUS" and turn the event marker on to have it printed on the chart.

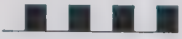
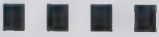
7 Press the soft key above "LOCATION."

8 Use the encoder wheel to specify the location in millimeters on the chart at which you want the event marker to print.

- The event marker can be placed at locations from 0 millimeters (near the bottom of the chart) to 253 millimeters (near the top of the chart).

CHANGE EVENTS:
selecting a global event marker style

Event markers can be printed in any of four styles:

- standard
- tick mark
- block/line 
- block/off 

CHANGE EVENTS:
selecting a global event marker style

Use the following procedure to select the event marker style that you want. The style you select will apply to all of the event markers.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "MODIFY CHART."**

3 **Press the soft key above "CHANGE EVENTS."**

4 **Press the soft key below "STYLE."**

5 **Use the encoder wheel to select the event marker style that you want.**

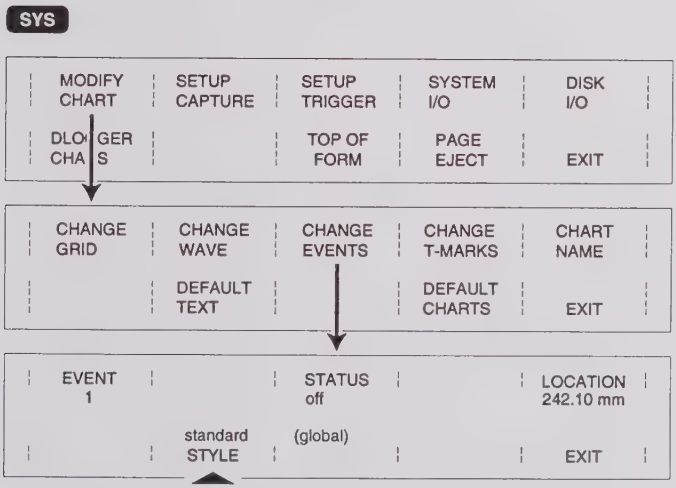


CHART NAME:
editing/creating a name for a stored recording format

Use the following procedure to create or name a recording format that you are saving to diskette or to one of the recorder's soft keys.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "MODIFY CHART."**

3 **Press the soft key above "CHART NAME."**

4 **Press the soft key above the chart name you want to edit.**

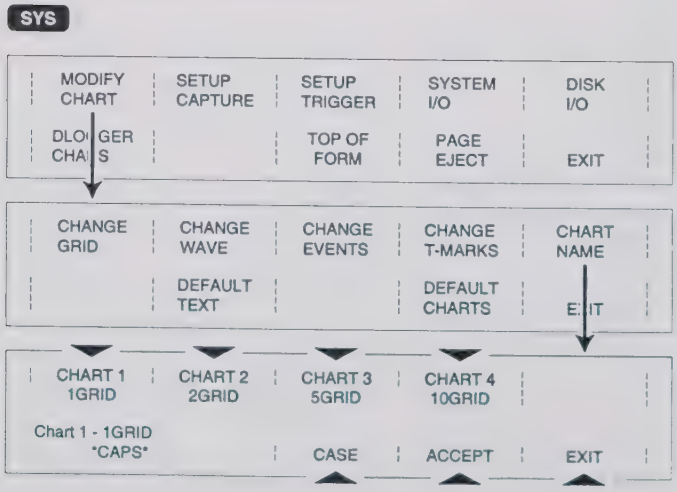
- **This selects the name for editing.**

5 **Press the soft key below "CASE" to select upper- or lower-case lettering for the name you will create.**

6 **Use the alphanumeric keypad to type the name you want.**

7 **Press the soft key below "ACCEPT."**

8 **Press the soft key below "EXIT."**



DEFAULT TEXT:
printing default text in annotation buffers

The DEFAULT TEXT selection resets all interchannel annotation buffers so that they each print a simple line of channel identification text such as "CHANNEL 1."

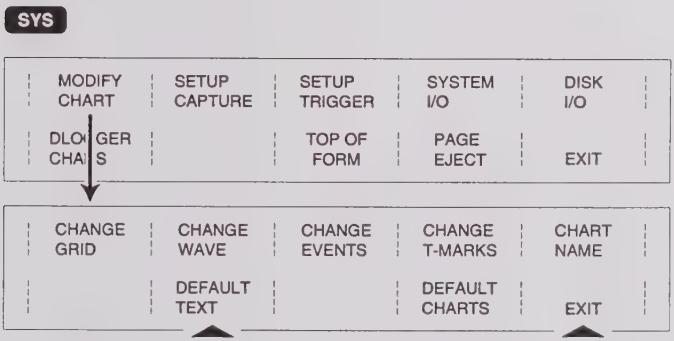
Use the procedure below to default all interchannel annotation buffers to the basic channel identification text.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "MODIFY CHART."**

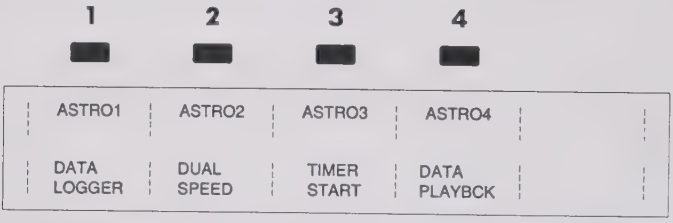
3 **Press the soft key below "DEFAULT TEXT."**

4 **Press the soft key below "EXIT."**



DEFAULT CHARTS: selecting a default chart layout

The DASH 10 has four front-panel programmable CHART keys.



The DEFAULT CHARTS selection resets any selected front-panel CHART soft key to any of four preset chart layouts. For a ten-channel configuration, these layouts are:

- ASTRO1—provides a single channel that is 200mm wide.
- ASTRO2—provides two channels each of which are 100mm wide.
- ASTRO3—provides five channels each of which is 40mm wide.
- ASTRO4—provides four channels each of which is 20mm wide.

Twenty-channel systems provide an additional chart layout:

- ASTRO5—provides 20 channels each of which is 8mm wide.

In additional to the above chart layout choices, thirty-channel systems provide:

- ASTRO6—provides 15 channels each of which is 10mm wide.
- ASTRO7—provides 30 channels each of which is 5mm wide.

Examples of each of the default chart layouts are provided on the pages that follow. Use the procedure on the next page to set any of the programmable chart keys to any of the four default chart layout selections.

DEFAULT CHARTS:
selecting a default chart layout

1 Press the front-panel [SYS] key.

2 Press the soft key above "MODIFY CHART."

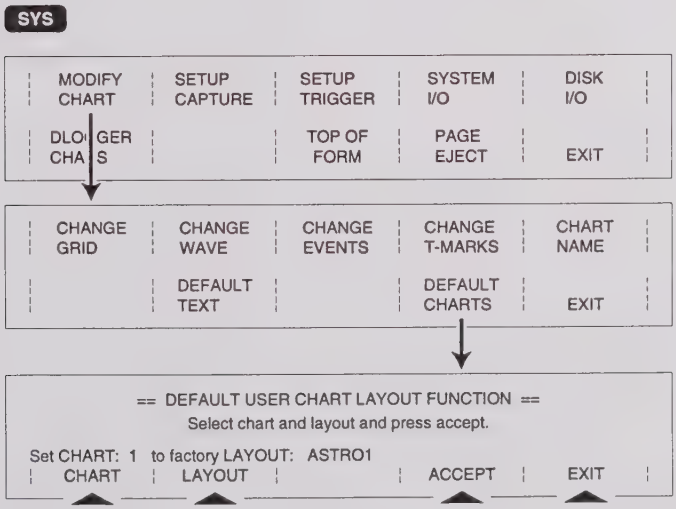
3 Press the soft key below "DEFAULT CHARTS."

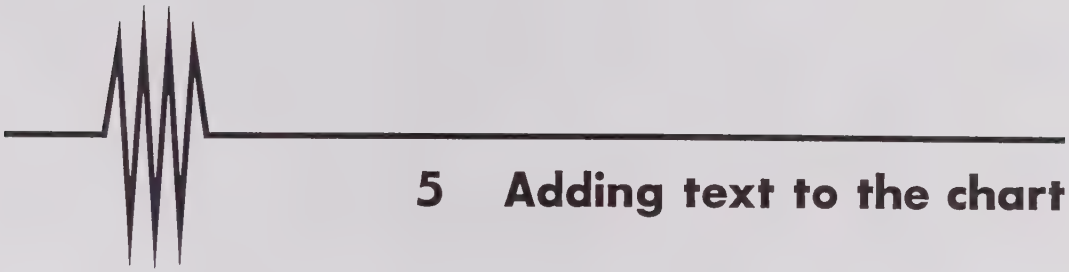
4 Press the soft key below "CHART" to select the chart soft key that you want to program with a default layout.

5 Press the soft key below "LAYOUT" to select the default chart layout that you want to program into the soft key.

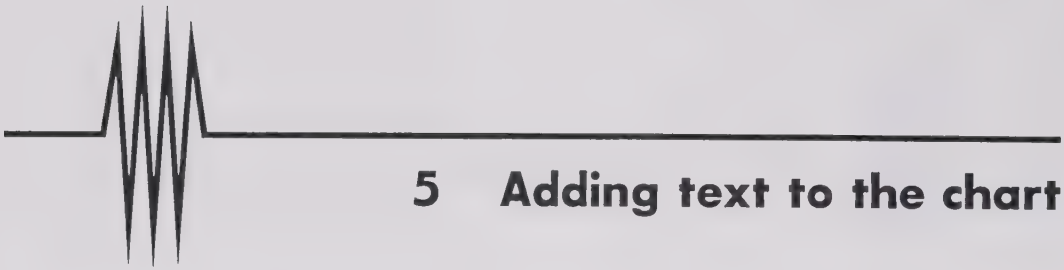
6 Press the soft key beneath "ACCEPT."

7 Press the soft key below "EXIT."





5 Adding text to the chart



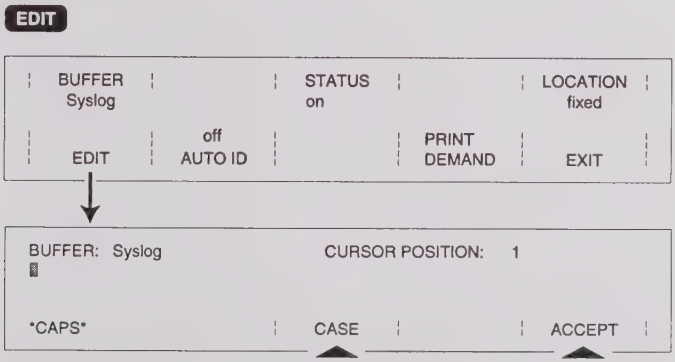
5 Adding text to the chart

Adding text to the chart

When you need to add alphanumeric text to the your charts, the DASH 10 provides a variety of annotation tools. The DASH 10 is equipped with:

- thirty 128-character annotation buffers each of which can be moved to any of 95 positions across the chart.
- one 128-character on-demand annotation buffer that can be printed when you want in any of 95 locations across the chart.
- one system log buffer containing the time, date, and chart speed fixed near the top of the chart.
- capacity to print channel identification numbers either on-demand or automatically and continuously.

The front-panel [EDIT] key is used to add text to your chart and to edit text on your chart. The [EDIT] key menu flow is shown below.



The following procedures are discussed in this section:

- turning the printing of text buffers on and off.
- editing the alphanumeric content of the text buffers.
- positioning text buffers on the chart.
- printing and positioning the on-demand text buffer.
- printing automatic, continuous channel identification numbers.

5.1.1

Enabling or suppressing printing of text buffers

The printing status of any of the annotation buffers can be set to either on or off. When set to "on" the selected buffer will print the text that you have typed at the chart location that you have selected. When set to "off" the selected buffer will not be printed.

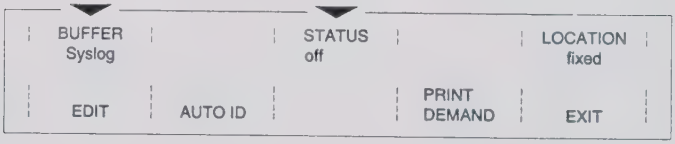
1 **Press the front-panel [EDIT] key.**

2 **Press the soft key above "BUFFER."**

3 **Use the encoder wheel to select the text buffer that you want to print or suppress.**

4 **Press the soft key above "STATUS."**

- **Turn the status to "on" to enable printing of the selected buffer.**
- **Turn the status to "off" to prevent the selected buffer from printing.**



5.1.2

Editing text buffers

Text buffers are synchronized with one another and, when turned on, are printed repeatedly and continuously at a standard distance on the chart. Each buffer can hold up to 128 alphanumeric characters. You can position the text buffers to print with specific channels or you can position them completely independently of the channels.

Editing text buffers

You can even group any or all of the text buffers together on the chart to create an extended block of annotation comments.

Use the procedures that follow to edit any of the thirty interchannel text buffers, the on-demand text buffer, or the recorder's system log.

1 **Press the front-panel [EDIT] key.**

2 **Press the soft key above "BUFFER."**

3 **Use the encoder wheel to select the text buffer that you want to edit.**

4 **Press the soft key below "EDIT."**

5 **If you want your typing to be in upper case letters, press the soft key below "CASE" until the word *CAPS* appears in the display.**

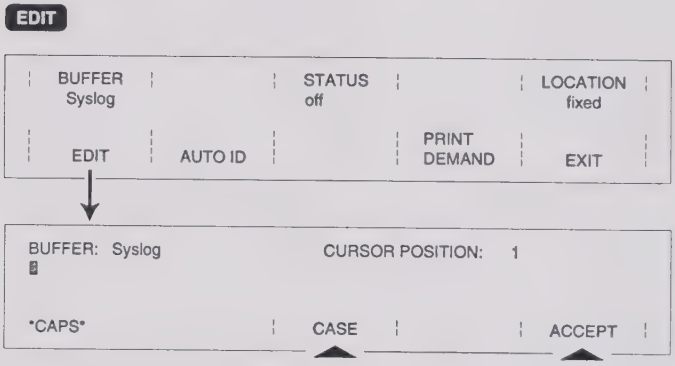
6 **Use the alphanumeric keypad to position and type the text you want to appear in the buffer. There is enough room for a 128-character message.**

- **Use the arrow keys of the keypad to move through the text buffer.**
- **Note that a number indicating the location of the cursor within the buffer is shown in the display.**
- **Use the alphanumeric keys of the keypad to type the letters, numbers, and symbols that you want.**
- **Use the [SPACE] key to add a blank space before a character.**
- **Use the [DEL] key to delete a selected character.**
- **Use the [INS] (insert) key to insert text before a selected character without overwriting any existing text.**

5.1.2

Editing text buffers

6 Press the soft key below "ACCEPT" to confirm the buffer contents that you just typed.



5.1.3

Positioning a text buffer on the chart

1 Press the front-panel [EDIT] key.

2 Press the soft key above "BUFFER."

3 Use the encoder wheel to select the text buffer that you want to position.

4 Press the soft key above "LOCATION."

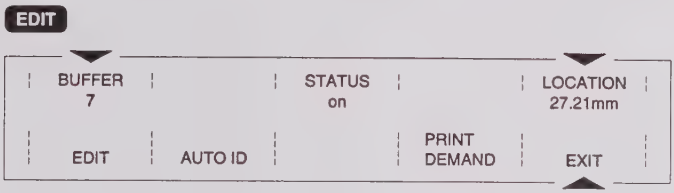
5 Use the encoder wheel to select the chart location at which you want the text buffer printed.

- There are 95 locations across the chart.
- See the illustration at the top of the next page.

5.1.3

Positioning a text buffer on the chart

6 **Press the soft key below "EXIT."**



5.1.4

Printing the on-demand text buffer

The on-demand text buffer is immediately printed when the front-panel [EDIT] key is pressed and then the soft key beneath "PRINT DEMAND" is pressed.

1 **Press the front-panel [EDIT] key.**

2 **Press the soft key above "BUFFER."**

3 **Use the encoder wheel to select the "Demand" text buffer.**

4 **Ensure that the print status of the buffer is set to "on."**

5 **Ensure that the buffer contains the text that you want.**

6 **Press the soft key above "LOCATION."**

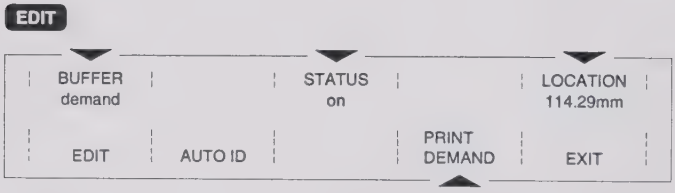
7 **Use the encoder wheel to select the chart location at which you want the on-demand buffer printed.**

5.1.4

Printing the on-demand text buffer

8 **Press the soft key below "PRINT DEMAND."**

- **The on-demand text buffer will be printed immediately at the chart location you selected.**



5.2

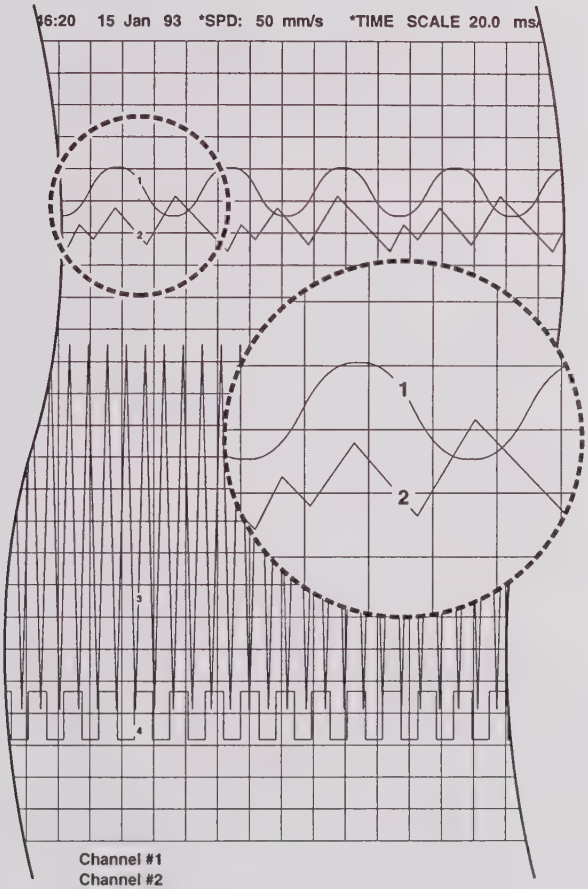
Printing channel ID numbers

As shown in the illustration on the next page, the DASH 10 can print channel identification numbers to clearly indicate the channel number of either all or individually selected waveform channels. Channel ID numbers can be made to print in any of three ways:

- using the front-panel [ID] key to simultaneously label all waveforms with their channel numbers a single time.
- using the alphanumeric keypad and the front-panel [ID] key to label either all waveforms or individual waveforms a single time with their channel numbers and the voltage values of the selected channel's grid edges.
- using the recorder's AUTO ID function to simultaneously label all waveforms with their channel numbers automatically and continuously.

Channel identification numbers provide a simple way of quickly locating each waveform channel on the chart. This is especially useful when waveforms overlap during recording.

Printing channel ID numbers



5.2

Printing channel ID numbers

To simultaneously label all waveforms with their channel numbers a single time:

1 **Press the front-panel [ID] key.**

- **Each time the [ID] key is pressed, a channel identification number will be printed either on or near each of the waveforms on the chart.**

To label individual waveforms a single time with their channel numbers and the voltage values of the selected channel's grid edges:

1 **Press the number of the channel you want to label on the alphanumeric keypad**

2 **Press the front-panel [ID] key.**

- **Each time a channel number is pressed on the alphanumeric keypad followed by pressing the [ID] key,**

  - **the channel number will be printed on the selected waveform a single time.**

  - **the voltage value of the waveform channel will be printed on the channel's grid edges.**

To label all waveforms a single time with their channel numbers and the voltage values of the selected channel's grid edges:

1 **Press the zero (0) on the alphanumeric keypad**

2 **Press the front-panel [ID] key.**

- **Channel numbers will be printed on all waveforms a single time.**

- **The voltage values of each waveform channel will be printed on the channel's grid edges.**

Printing channel ID numbers

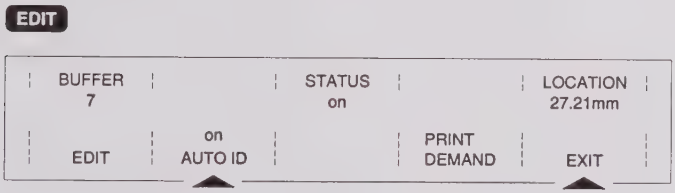
You can also make channel ID numbers print automatically and continuously by setting the status of the recorder's AUTO ID function to "on."

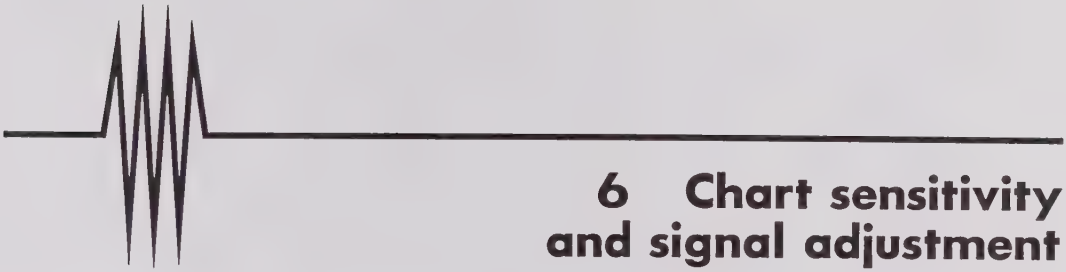
Follow the procedure below to enable automatic printing of channel ID numbers.

1 **Press the front-panel [EDIT] key.**

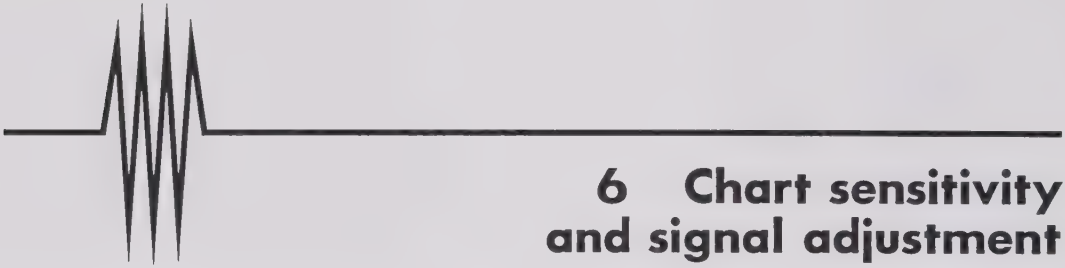
2 **Press the soft key beneath "AUTO ID" until the setting reads "on."**

3 **Press the soft key below "EXIT."**





6 Chart sensitivity and signal adjustment

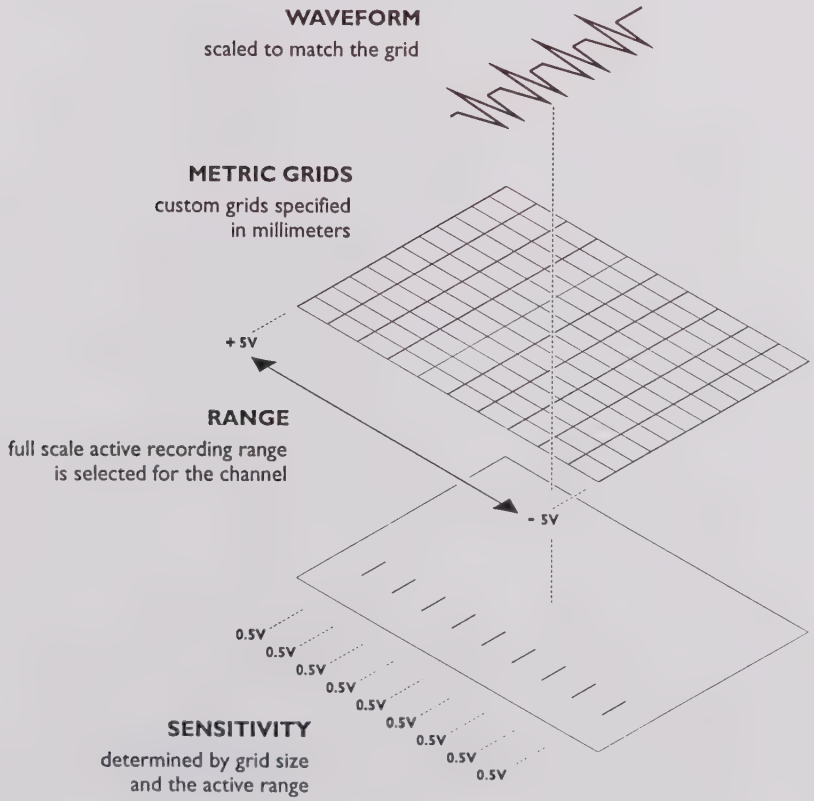


6 Chart sensitivity and signal adjustment

Chart sensitivity in the DASH 10

In the DASH 10 recorder:

- grids are metric and can be custom designed with varied arrangements of major and minor divisions.
- an active recording range is selected using zero and gain menus.
- sensitivity is determined by the size of the grid and the active range.
- sensitivity is expressed in V/cm.
- the recorded waveform is scaled to match the grid.



DASH 10 zero and gain controls

For each of the DASH 10's thirty recording channels, the [Z/G] key (zero and gain) key is used to:

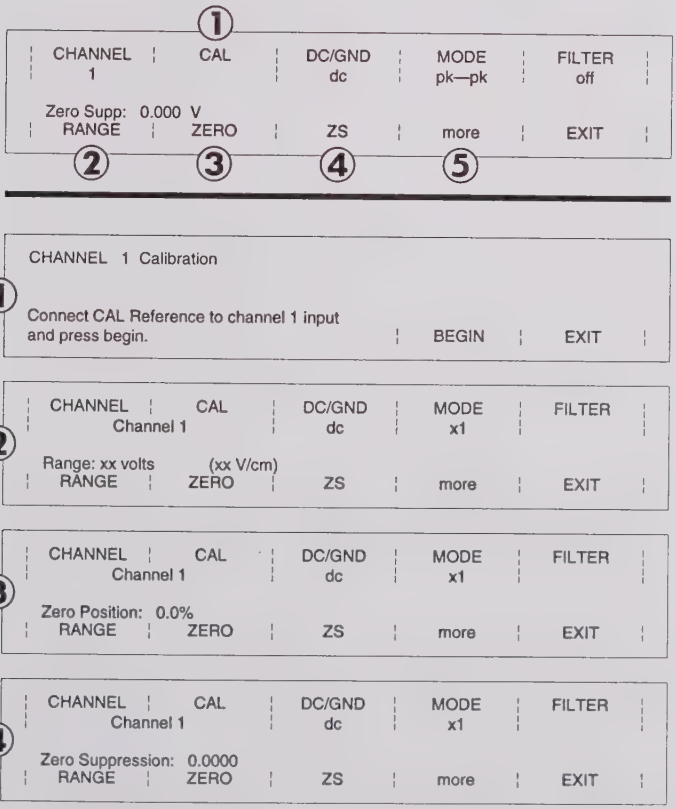
- select a voltage range for the chart.
- select a chart location for the zero baseline of the waveform input signal.
- suppress up to 500 VDC of the waveform input to enable the use of higher gains without exceeding the recorder's range.
- ground the signal.
- choose between RMS and peak-to-peak recording modes.
- enable or disable signal filtering.
- scale waveform data so that voltage data is expressed in engineering units of your choice.
- calibrate each channel to an internal precision reference.

The parameters of the [Z/G] key are summarized below. The complete menu flow for the [Z/G] key is shown on pages 6-3 and 6-4.

- CAL — initiates a channel calibration procedure that compares the channel to the DASH 10's built-in precision voltage reference.
- DC/GND — grounds the selected waveform input signal.
- MODE — selects between peak-to-peak and RMS recording modes for the specified recording channel.
- FILTER — enables or disables the recorder's 10 Hz low-pass filter.
- RANGE — selects the channel's active voltage range from grid edge to grid edge.
- ZERO — selects a chart location for the zero baseline of the waveform input.

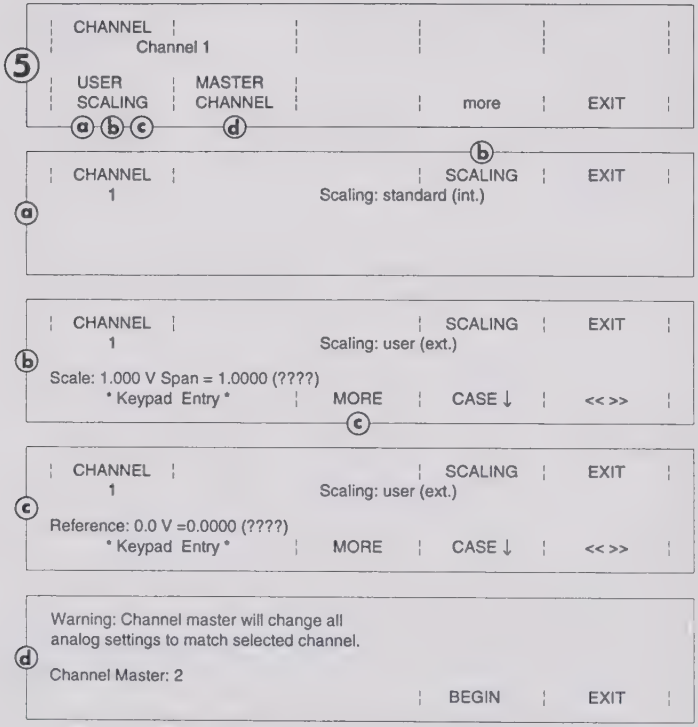
DASH 10 zero and gain controls

- **ZS** — selects the amount of zero suppression in VDC that will be applied to a channel's waveform input signal.
- **USER SCALING** — selects between the recorder's standard (internal) scaling and user-defined (external) scaling values. Externally supplied scaling values are used to convert voltage values into user-defined engineering units.
- **MASTER CHANNEL** — Sets all channels to the analog settings of a selected "master channel."



6.2

DASH 10 zero and gain controls



6.2.1

Setting a selected channel's voltage range

Use the following procedure to set the selected channel's voltage range.

1 **Press the front-panel [Z/G] key.**

2 **Press the soft key above "CHANNEL."**

3 **Use the encoder wheel to select the channel for which you want to set the range.**

Setting a selected channel's voltage range

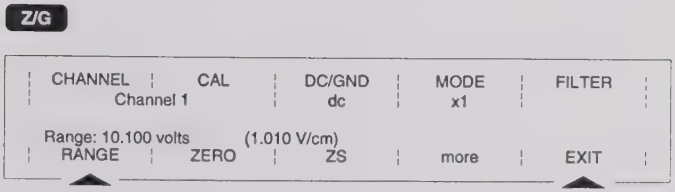
4 Press the soft key below "RANGE."

- The are two ways to specify the range you want to use:
  - When the **RANGE** parameter is active (blinking), the numeric keypad can be used to enter the range in volts (terminate with **ENTER**).

    The keypad can also be used to enter the zero position and the amount of zero suppression desired when those parameters are selected.
  - The encoder wheel can be used to set the voltage range in volts or millivolts for the selected channel.
- Ranges are incremented as shown in the table below.

range				increment	
50	to 200	mV	.....	1	mV
200	to 500	mV	.....	2	mV
500	to 1000	mV	.....	5	mV
1000	to 2000	mV	.....	10	mV
2000	to 5000	mV	.....	20	mV
5	to 10	V	.....	.05	V
10	to 25	V	.....	.1	V
25	to 100	V	.....	.5	V
100	to 250	V	.....	1	V
250	to 500	V	.....	5	V

5 Press the soft key below "EXIT" to leave the [Z/G] menu.



6.2.2

Selecting either the peak-to-peak or RMS recording mode

The DASH 10 can record data using either the peak-to-peak recording method or the root-mean-square method. Use the procedure below to select the mode you want to use.

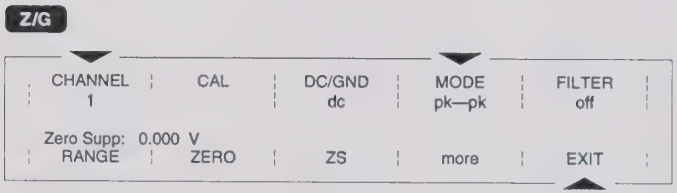
1 **Press the front-panel [Z/G] key.**

2 **Press the soft key above "CHANNEL."**

3 **Use the encoder wheel to select the channel of interest.**

4 **Press the soft key above "MODE" until the recording mode that you want is selected.**

5 **Press the soft key below "EXIT" to leave the [Z/G] menu.**



6.2.3

Grounding individual waveform channels

Use the following procedure to ground selected waveform channels.

1 **Press the front-panel [Z/G] key.**

2 **Press the soft key above "CHANNEL."**

3 **Use the encoder wheel to select the channel of interest.**

4 **Press the soft key above "DC/GND" until ground (gnd) is selected in the menu.**

6.2.3

Grounding individual waveform channels

5 **Press the soft key below "EXIT" to leave the [Z/G] menu.**

6.2.4

Positioning a waveform's zero baseline

NOTE

The waveform's zero baseline can be positioned using the ZERO parameter discussed below or using the recorder's zero suppression capability. Applying zero suppression to a waveform signal is discussed in paragraph 6.2.5.

Depending on your specific purpose, it can be useful to use the ZERO control to move the baseline in fine steps and to use zero suppression for applications that involve a large DC bias.

When positioning the waveform in the channel, the center of grid is used as the reference location. See the illustration on the next page.

Use the procedure below to select a chart location for the zero baseline of the waveform with reference to the center of the grid.

1 **Press the front-panel [Z/G] key.**

2 **Press the soft key above "CHANNEL."**

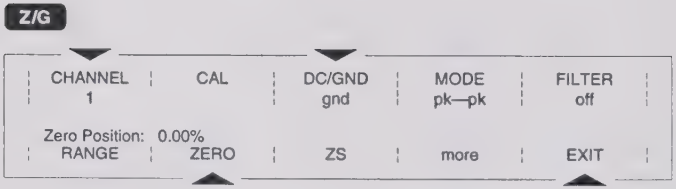
Positioning a waveform's zero baseline

3 Use the encoder wheel to select the channel of interest.

- If you find it useful, ground the signal by pressing the soft key above "DC/GND."
- This will provide a flat zero-baseline that is easily positioned on the chart.

4 Press the soft key below "ZERO."

- Note the "Zero Position:" parameter that appears in the menu.



5 Use the encoder wheel to specify a percentage.

- The percentage that you specify is the percentage of the selected voltage range that will be applied to the baseline.
- Positive values shift the baseline to the left. Negative values shift the baseline to the right.
- When the "Zero Position" parameter is selected (blinking), the numeric keypad can also be used to select the desired zero baseline position.

Applying zero suppression to waveform signals

Some waveform input signals may contain an unwanted direct-current (DC) component. The signal's DC component may make it difficult to bring the waveform data of interest onto the chart.

For ranges greater than or equal to 5V, zero suppression can be used to remove from -500V to +500V of a waveform's DC component. For ranges less than 5V, zero suppression can be used to remove from -5V to +5V of a waveform's DC component. This can help to bring the data of interest onto the chart for recording and analysis.

Use the procedure below to select the amount of zero suppression that will be applied to the waveform input signal.

1 **Press the front-panel [Z/G] key.**

2 **Press the soft key above "CHANNEL."**

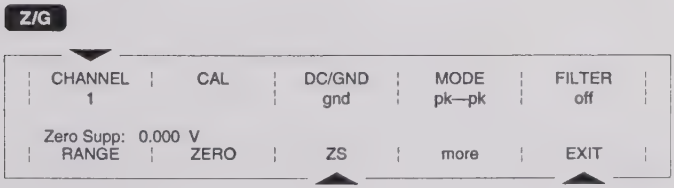
3 **Use the encoder wheel to select the channel of interest.**

4 **Press the soft key below "ZS."**

5 **Use the encoder to select the amount of zero suppression that you want to apply to the waveform input.**

- **When the "Zero Supp:" parameter is selected (blinking), the numeric keypad can also be used to set the desired amount of zero suppression.**

6 **Press the soft key below "EXIT" to leave the [Z/G] menu.**



6.2.6

Using the recorder's low-pass signal filter

Use the procedure below to select a filter that will be applied to the waveform input signal.

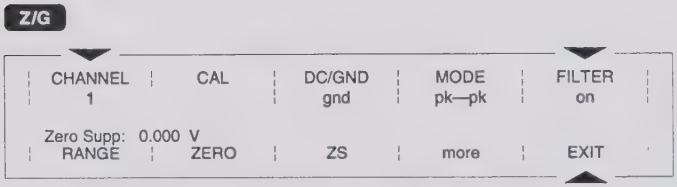
1 **Press the front-panel [Z/G] key.**

2 **Press the soft key above "CHANNEL."**

3 **Use the encoder wheel to select the channel of interest.**

4 **Press the soft key above "FILTER" until the recorder's 10 Hz low pass filter is turned "on."**

5 **Press the soft key below "EXIT" to leave the [Z/G] menu.**



6.2.7

Converting voltage data to engineering units for numeric reporting

When you are recording changes in temperature, pressure, or any other quantity that is not specifically voltage, it can be very convenient to have the DASH 10 print your data as numeric engineering units rather than waveforms on a grid.

When recording with the DASH 10, all signal information enters the recorder as electrical voltage. The recorder's "USER SCALING" feature is used to convert these voltages into numeric data that directly corresponds to the units of pressure, temperature, etc. that you are interested in monitoring.

Converting voltage data to engineering units for numeric reporting

Numeric scaling begins with selecting the voltage range of the channel in millivolts or volts. The "USER SCALING" parameter is used to redefine the voltage range of the chart as the engineering units you desire. The DASH 10 will then convert all of the signal voltage data into the engineering units you have specified.

When USER SCALING is used, all pertinent DASH 10 menus will be displayed in the engineering units that you define. Use the procedure below to convert the electrical value of the waveform input data into engineering units that you specify.

1 **Press the front-panel [Z/G] key.**

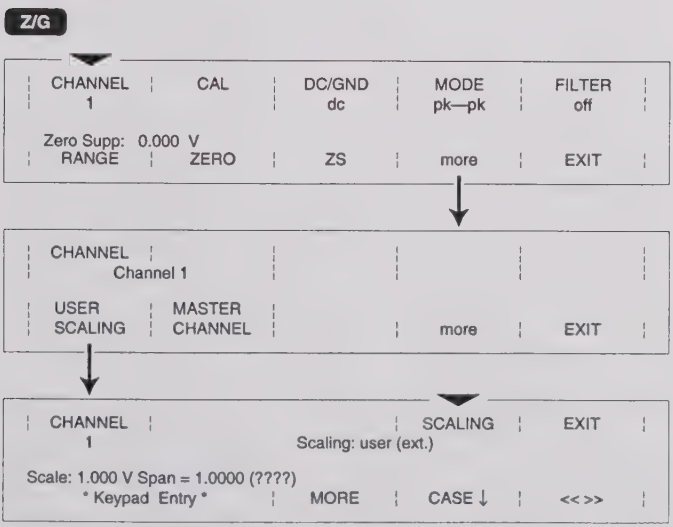
2 **Press the soft key above "CHANNEL."**

3 **Use the encoder wheel to select the channel of interest.**

4 **Press the soft key below "more."**

5 **Press the soft key below "USER SCALING."**

6 **Press the soft key above "SCALING" until user scaling is selected.**



Converting voltage data to engineering units for numeric reporting

7 Note that the scaling menu is used to define three values:

- Scale — the voltage increment that will be defined as equaling one engineering-unit increment.
- Span — - the engineering-unit increment that will be defined as equaling one voltage increment.
  - the name or label of the engineering-unit increment (PSI, mmHg, etc.).

8 Press the soft key below "<< >>" and select the Scale parameter.

9 Use the numeric keypad to define the amount of voltage that will equal one engineering unit.

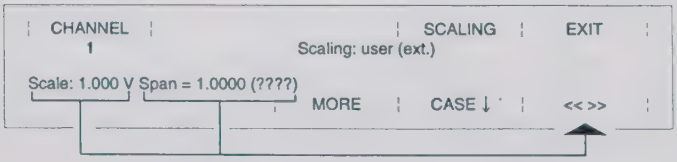
- Terminate all alphanumeric keypad entries by pressing the keypad's [ENTER] key.

10 Press the soft key below "<< >>" and select the Span parameter.

11 With the "Span" parameter selected, use the alphanumeric keypad to define the number of engineering units that will equal one increment of the voltage scale.

- Terminate all alphanumeric keypad entries by pressing the keypad's [ENTER] key.

12 Press the soft key below "<< >>" and select the parameter used to type a label or name for the engineering units (????).



6.2.7

Converting voltage data to engineering units for numeric reporting

13 **Use the alphanumeric keypad to type a maximum of four-characters to name the engineering unit (i.e., mmHg, PSI).**

- **Note that typing can be in either upper- or lower-case letters (CASE).**
- **Terminate all alphanumeric keypad entries by pressing the keypad's [ENTER] key.**

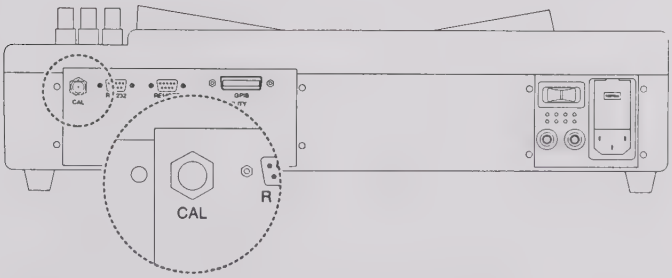
6.2.8

Calibrating individual channels with the DASH 10's built-in precision voltage references

For the purpose of system calibration, the DASH 10 is equipped with two extremely precise internal voltage references: 2.5V and 10V.

Use the procedure given below to calibrate each channel to the recorder's precision voltage references.

1 **Locate the CAL phone plug connector on the rear panel.**



Calibrating individual channels with the DASH 10's built-in precision voltage references

2 **Run a connector cable from the rear-panel CAL micro phone-plug connector to the front-panel signal inputs of any of the recorder's channels.**

- **The cable must use the BNC female to micro plug (supplied with the recorder) and a dual banana-jack connector.**

NOTE

The voltage reference must be connected to one channel at a time. Do not daisy chain the voltage reference to multiple channels.

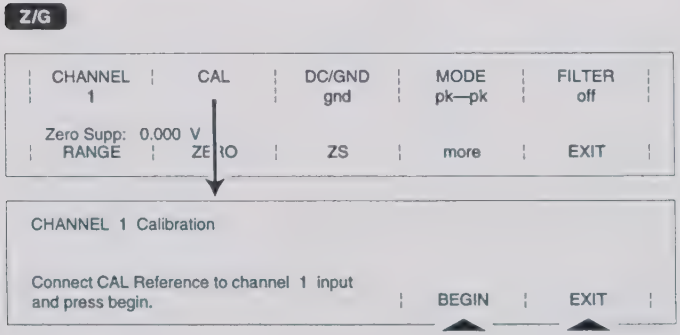
3 **Press the front-panel [Z/G] key.**

4 **Press the soft key above "CAL."**

5 **Use the encoder wheel to select the number of the channel that you want to calibrate.**

6 **Press the soft key below "BEGIN."**

7 **Press the soft key below "EXIT" to leave the calibration menu.**



Using MASTER CHANNEL to change all analog settings

The DASH 10's MASTER CHANNEL function provides a convenient method for simultaneously changing the analog settings of all channels to the settings of a single "MASTER CHANNEL" that you select.

Use the procedure given below to use the MASTER CHANNEL function.

1 **Press the front-panel [Z/G] key.**

2 **Press the soft key below "more."**

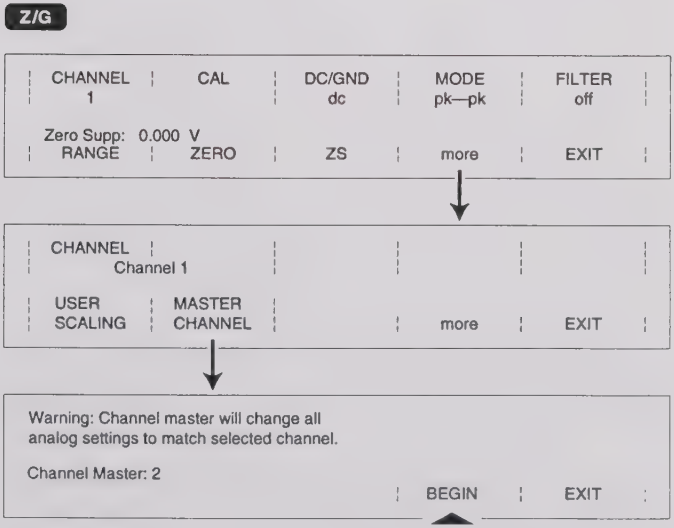
3 **Press the soft key below "MASTER CHANNEL."**

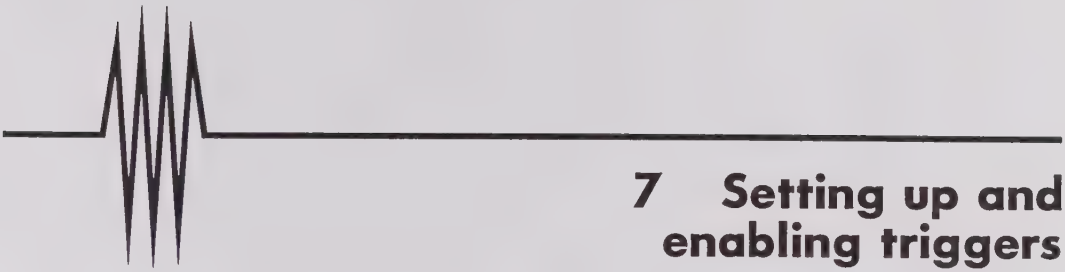
4 **Use the encoder wheel to select the number of the channel that you want to use as the master channel.**

- **The analog settings of all channels will be changed to the settings of the master channel you select.**

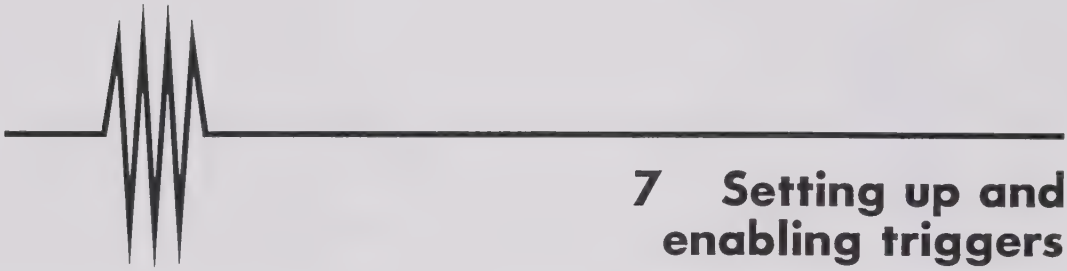
5 **Press the soft key beneath "BEGIN."**

- **The analog settings of all channels are automatically changed to the settings of the master channel.**





7 Setting up and enabling triggers



7 Setting up and enabling triggers

DASH 10 triggering capabilities

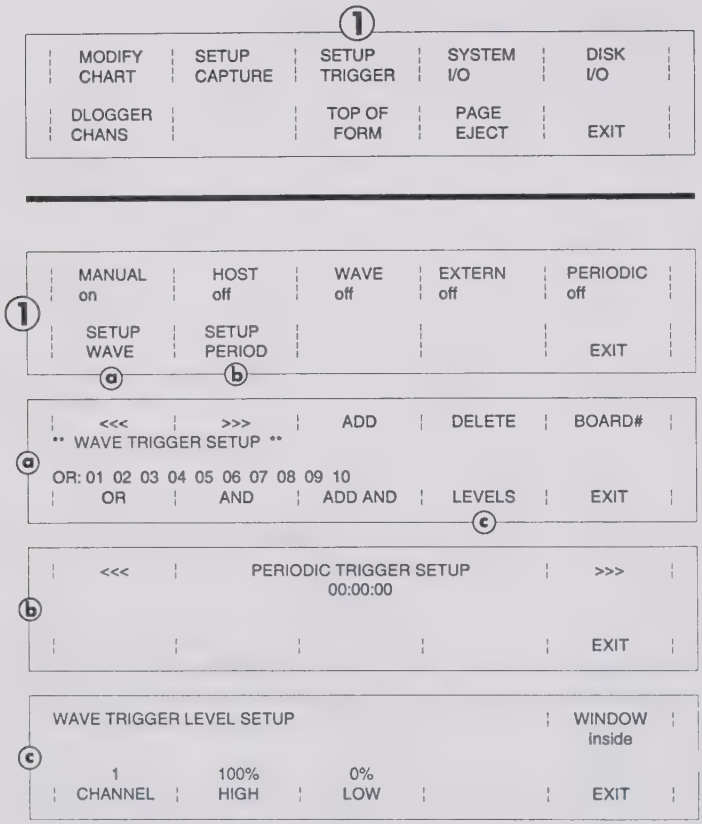
The DASH 10 has one net trigger. The trigger can be generated by any of four sources:

- MANUAL — triggers generated when the front-panel [TRIG] key is pressed.
- HOST — triggers generated on command from a host computer.
- WAVE — waveform-generated triggers occurring when a signal exceeds or falls below user-defined trigger limits.
- EXTERNAL — externally generated triggers communicated through the rear-panel UTILITY D-shell.
- PERIODIC — triggers continuously generated at specific time intervals.

Triggers can be put together in AND and OR groups to create a large number of trigger combinations.

Triggers are defined using the menus of the "SETUP TRIGGER" parameter found in the system [SYS] key setups. The complete menu flow for all "SETUP TRIGGER" parameters is shown on the next page.

DASH 10 triggering capabilities



7.1

DASH 10 triggering capabilities

As the menu flow shows, the "SETUP TRIGGER" parameter is used to:

- turn trigger sources on or off.
- define OR trigger combinations and combined AND / OR trigger combinations.
- define voltage levels over which and below which the input signal will cause a trigger condition.

The paragraphs that follow present the detailed procedures for defining each of these trigger setups.

7.1.1

Turning on MANUAL, HOST, and EXTERNAL trigger sources

Trigger sources must be turned on in order for triggers to be generated. The simple procedure that follows explains how to turn on the five available trigger sources. Combining waveform trigger sources is discussed in paragraph 7.1.2, "Combining waveform trigger sources into trigger groups."

Use the procedure below to selectively turn on or turn off the recorder's trigger sources.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "SETUP TRIGGER."**

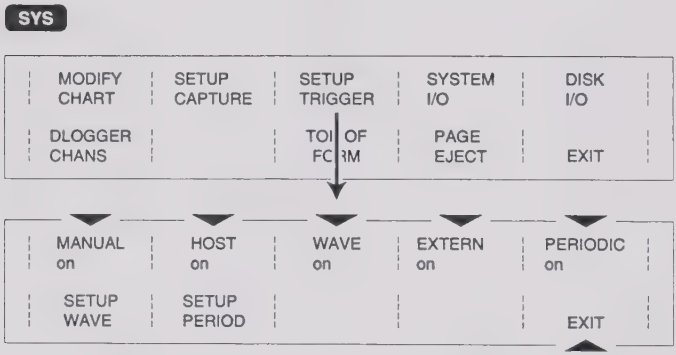
3 **Turn any of the five trigger source on or off by pressing the soft keys above:**

- **MANUAL**
- **HOST**
- **WAVE**
- **EXTERN**
- **PERIODIC**

7.1.1

Turning on MANUAL, HOST, and EXTERNAL trigger sources

4 **Press the soft key below "EXIT" to leave the "SETUP TRIGGER" parameter.**



7.1.2

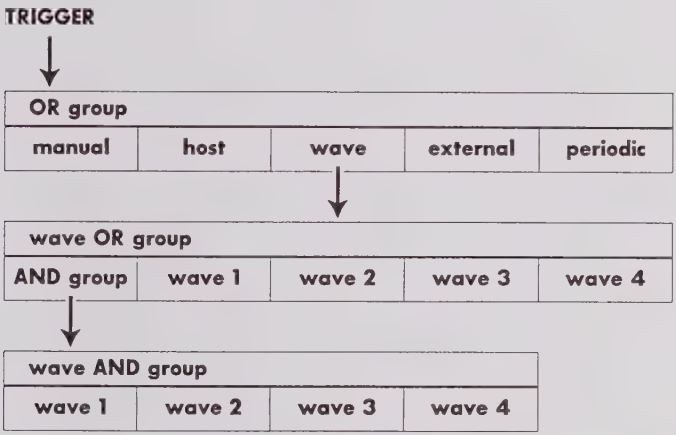
Combining waveform trigger sources into trigger groups

Trigger sources can be grouped to create a large number of triggering combinations. Waveforms are grouped as trigger sources by using the selections of the "SETUP WAVE" parameter to create both AND and OR triggering combinations.

- An OR trigger group allows you to combine one or more trigger sources so that a valid trigger in any one source generates a trigger.
- An AND trigger group allows you to combine waveform trigger sources so that a trigger is generated when valid trigger conditions are detected at the same time in all waveforms of the AND group.
- An AND trigger group is always part of a WAVE OR trigger group.

Combining waveform trigger sources into trigger groups

- Only channels from the same input board can be combined to form AND groups. Channels from different input boards cannot be formed into AND groups.



Use the procedure below to combine individual waveform trigger sources into AND / OR trigger groups.

1 **Press the front-panel [SYS] key.**

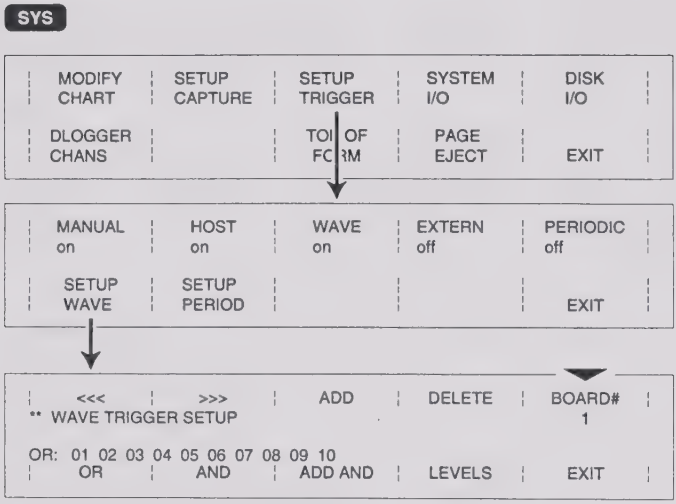
2 **Press the soft key above "SETUP TRIGGER."**

3 **Press the soft key below the "SETUP WAVE" parameter.**

4 **Press the soft key above "BOARD" to select the signal input board that has the waveform trigger sources that you want to add to the trigger expression.**

- **See the illustration at the top of the next page.**

Combining waveform trigger sources into trigger groups



5 Press the soft key below the "OR" parameter.

6 Press the soft key above "<<<" or ">>>" to select a waveform trigger source that you want either to add to or delete from the current OR trigger channel grouping.

7 Use the soft key above "ADD" to add triggers and use the encoder wheel to select the specific waveform sources that you want to be part of the the OR combination.

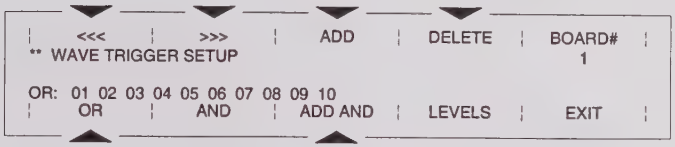
- OR "combinations" can consist of a single channel.

8 Press the soft key above "DELETE" to remove individual waveform trigger sources from the OR trigger combination you are creating.

9 Press the soft key below "ADD AND" to add the current AND group to the OR group you are creating.

- See the illustration at the top of the next page.

Combining waveform trigger sources into trigger groups



10 Press the soft key below the "AND" parameter.

11 Press the soft key above "<<<" or ">>>" to select a waveform trigger source that you want either to add to or delete from the current AND trigger channel grouping.

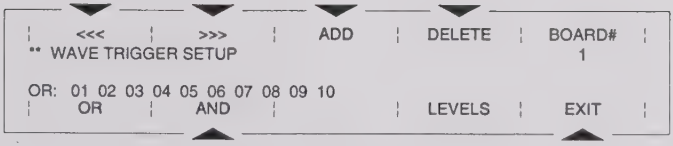
- Use the encoder wheel to change the selected (blinking) channel to the specific channel you want.

12 Press the soft key above "ADD" to add individual waveform trigger sources to the AND trigger combination you are creating.

- Use the encoder wheel to change the selected (blinking) channel to the specific channel you want.

13 Press the soft key above "DELETE" to remove individual waveform trigger sources from the AND trigger combination you are creating.

14 Press the soft key below "EXIT" to leave the "SETUP WAVE" parameter.



Setting trigger reference values

Trigger levels are reference values over which or below which triggers will be generated as a result of the activity of waveform trigger sources.

- Trigger levels are selected as 1% increments of the channel's A/D range.

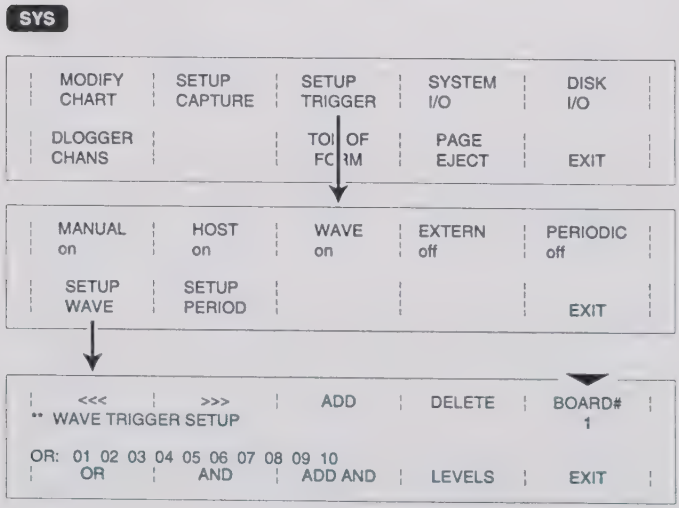
For each trigger channel, use the procedure on the following page to set trigger reference values.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "SETUP TRIGGER."**

3 **Press the soft key below the "SETUP WAVE" parameter.**

4 **Press the soft key above "BOARD" to select the signal input board that has the waveform trigger sources for which you want to set the trigger levels.**

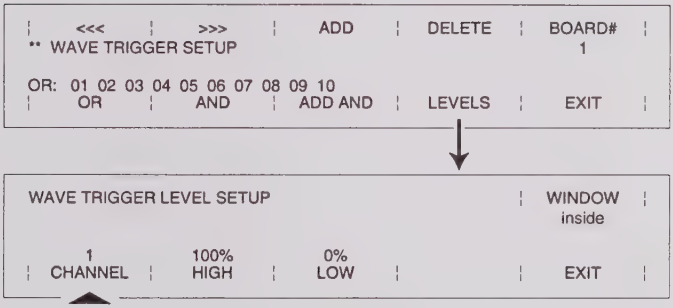


Setting trigger reference values

5 **Press the soft key below "LEVELS."**

6 **Press the soft key below "CHANNEL."**

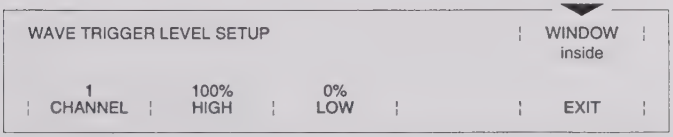
- **Select the channel for which you will be setting high and low reference values.**


<<< | >>> | ADD | DELETE | BOARD# 1
** WAVE TRIGGER SETUP
OR: 01 02 03 04 05 06 07 08 09 10
OR | AND | ADD AND | LEVELS | EXIT
WAVE TRIGGER LEVEL SETUP | WINDOW inside
1 CHANNEL | 100% HIGH | 0% LOW | EXIT

7 **Press the soft key above "WINDOW" and select either an outside or an inside window trigger condition.**

- **If an "outside window" trigger condition is selected and a trigger has been defined, a trigger will be generated when waveform activity falls outside the defined trigger window.**

- **If an "inside window" trigger condition is selected and a trigger has been defined, a trigger will be generated when waveform activity occurs inside the defined trigger window.**



Setting trigger reference values

8 Press the soft key below "HIGH" to set the upper limit of the trigger window.

9 With the high-level reference selected, use the encoder wheel to select a percentage value or to shut off the trigger-window's upper-limit reference value.

- Setting the "HIGH" level to "off" disables this parameter of the trigger window.
- The trigger-window will not have a reference value above which waveform activity will generate triggers.
- If the "HIGH" reference value of the trigger window has been turned off and the "LOW" reference value has been enabled, waveform triggers will be generated only when waveform activity falls below the defined "LOW" value.

10 Press the soft key below "LOW."

11 With the low-level reference selected, use the encoder wheel to select a percentage value or to shut off the trigger-window's lower-limit reference value.

- Setting the "LOW" level to "off" disables this parameter of the trigger window.
- The trigger-window will not have a reference value below which waveform activity will generate triggers.
- If the "LOW" reference value of the trigger window has been turned off and the "HIGH" reference value has been enabled, waveform triggers will be generated only when waveform activity occurs above the defined "HIGH" value.
- See the illustration on the next page.

7.1.3

Setting trigger reference values

12 **Press the soft key below "EXIT" to leave the "SETUP WAVE" parameter.**

7.1.4

Setting up a periodic trigger

The "SETUP PERIODIC" parameter can be used to setup triggers that are generated periodically and automatically.

Use the procedure on the following page to setup automatic periodic triggers.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "SETUP TRIGGER."**

3 **Press the soft key above "PERIODIC" until the selection reads "on."**

4 **Press the soft key below the "SETUP PERIOD" parameter.**

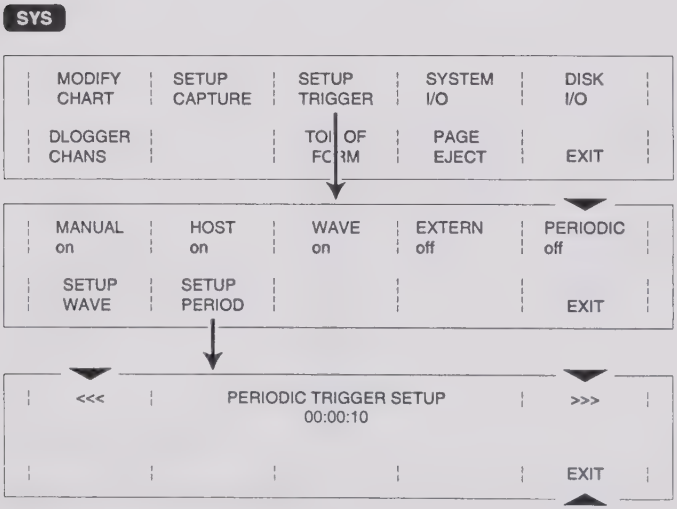
5 **Press the soft key above "<<<" or ">>>" to individually select the hours, minutes, and seconds parameters of the periodic trigger you are defining.**

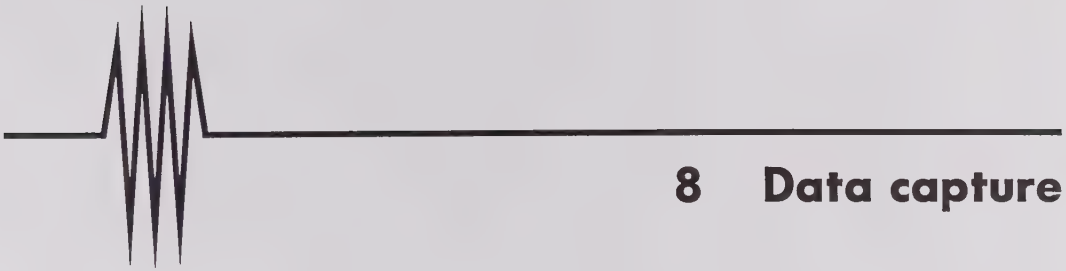
- **See the illustration on the next page.**

Setting up a periodic trigger

6 **As each component of the time parameter is selected, use the encoder wheel to set the time in hours, minutes, and seconds.**

7 **Press the soft key below "EXIT" to leave the "SETUP PERIOD" parameter.**





8 Data capture

8 Data capture

8.1

About capturing data with the DASH 10

In order to capture data, the DASH 10 must be equipped with data-capture memory and software.

When equipped with the data-capture capability, the DASH 10's waveform input signal boards each contain six megasamples of volatile memory for the storage of data capture records. This means that a DASH 10 with three analog waveform boards can be equipped with a maximum of eighteen megasamples of data-capture record storage. Each data-capture board can capture data independently from any other data-capture boards that may be present in the system.

NOTE

When capturing data it is important to keep in mind that data-capture memory is volatile. As explained later in this section, it is essential to store data-capture records to nonvolatile media such as floppy disks if you want to retain the data. If captured data is not stored to nonvolatile media, the data will be lost if power to the recorder is interrupted or if the recorder is shut off.

Data capture in the DASH 10 offers the following:

- four data capture methods:
  - single capture

    upon arming the system, single records are acquired without data playback and without interrupting real-time recording. Acquisitions are individually added to the inventory of records in system memory.

  - single capture w/playback.

    upon arming the system, single records are acquired. Playback immediately follows capture completion. Real-time recording is aborted during playback and the record is retained in the inventory of records in the system.

About capturing data with the DASH 10

- multi-capture (stacking)

  multiple records are captured one after another. Playback is not automatic. Records are saved in memory for later manipulation.

- continuous capture w/playback.

  records are acquired, played back, and deleted and subsequent acquisitions are captured under the same record number. Records are not saved.

- two data-capture record size options based on segmented or unsegmented use of data-capture memory.
- maximum of eight data-capture records per board.
- fifteen sample rates:
  - 5 Hz, 10 Hz, 25 Hz, 50 Hz, 100 Hz, 250 Hz, 500 Hz, 1 kHz, 2.5 kHz, 5 kHz, 10 kHz, 25 kHz, 50 kHz, 125 kHz, 250 kHz.
- sample rates result in the following data-capture playback timebases:
  - 4 s/mm, 2 s/mm, 800 ms/mm, 400 ms/mm, 200 ms/mm, 80 ms/mm, 40 ms/mm, 20 ms/mm, 8 ms/mm, 4 ms/mm, 2 ms/mm, 800 µs/mm, 400 µs/mm, 160 µs/mm, 80 µs/mm.

The essence of data capture is the acquisition and storage of real-time waveform data as the result of either a command or the occurrence of an initiating trigger. In the data-capture setups described on the pages that follow, it is assumed that you have setup the trigger conditions that you want. See section 7,"Setting up and enabling triggers."

Data capture in the DASH 10 always requires:

- data capture memory and software.
- defining and turning on triggers.
- arming the system to respond to triggers.

About data-capture memory

The DASH 10 can be equipped with a maximum of three data-capture boards.

- Each data-capture board contains six megasamples of memory.
- Each board has the capability to capture eleven channels of information. The eleven channels consists of 10 waveform channels and 1 event channel.

Data-capture memory can be setup in either nonsegmented or segmented configurations.

- nonsegmented memory
  - uses the data-capture board's entire 6-megasample memory as one record.

board 1 (channels 1 - 10)	board 2 (channels 11 - 20)	board 3 (channels 21 - 30)
record #1 6 megasamples	record #1 6 megasamples	record #1 6 megasamples

- segmented memory
  - uses the 6-megasample memory as eight records each consisting of 768K.

board 1 (channels 1 - 10)	board 2 (channels 11 - 20)	board 3 (channels 21 - 30)
record #1 - 768K	record #1 - 768K	record #1 - 768K
record #2 - 768K	record #2 - 768K	record #2 - 768K
record #3 - 768K	record #3 - 768K	record #3 - 768K
record #4 - 768K	record #4 - 768K	record #4 - 768K
record #5 - 768K	record #5 - 768K	record #5 - 768K
record #6 - 768K	record #6 - 768K	record #6 - 768K
record #7 - 768K	record #7 - 768K	record #7 - 768K
record #8 - 768K	record #8 - 768K	record #8 - 768K

8.2

About data-capture memory

The number of samples-per-channel that a record contains is equal to the size of the record divided by the number of channels captured. For example:

- one nonsegmented record (6-megasample) in which 11 channels have been captured contains 558 ksamples/channel.
- one segmented record (768 ksamples) in which 11 channels have been captured contains 69 ksamples/channel.

The table below shows the relationship between the number of channels captured and the number of samples-per-channel for both segmented and nonsegmented data-capture memory.

	samples/channel	
channel	**segmented**	**nonsegmented**
1	768k	6144k
2	384k	3072k
3	256k	2048
4	192k	1536k
5	153k	1228k
6	128k	1024k
7	109k	877k
8	96k	768k
9	85k	682k
10	76k	614k
11	69k	558k

Data-capture setups

A number of parameters must be defined when data-captures are setup. In a DASH 10 equipped with the data-capture capability, the menus used to setup data capture are found under the "SETUP CAPTURE" parameter.

"SETUP CAPTURE" is one of the [SYS] key setups and is used to define the parameters listed below. The settings of these parameters apply to the specific data-capture board selected.

- BRD
  - specifies the analog input board containing the channel or channels that will be captured.

- SAMPLE RATE
  - specifies any of fifteen available sample rates resulting in any of fifteen available timebases for data-capture playback.

- TRIGGER POSITION
  - defines the relationship between the data-capture window and the trigger for all channels of the selected data-capture board. Enables or disables the autotrig function.

- RECORD SIZE
  - selects a record size for the next data capture that applies to all channels of the selected data-capture board.

- CAPTURE CONTROL
  - selects one of four data capture methods:

    single captures without automatic record playback.
    single captures with automatic record playback.
    multiple captures without playback.
    multiple captures with automatic record playback.

Data-capture setups

- RECORD STATUS
  - provides a tally of the number of records captured and allows individual records to be deleted, archived, or restored.
- LINK
  - in multiboard DASH 10 systems, enables channels on different data-capture boards to be in the same record.
- ENABLE / DISABLE
  - enables or disables specific channels and/or all event markers as data-capture sources.

In addition to these data-capture setups, the "SETUP CAPTURE" parameter provides an additional parameters that allow data-capture records to be deleted, saved to diskette, or uploaded from diskette. These menus are discussed in section 10, "Diskette-based input/output."

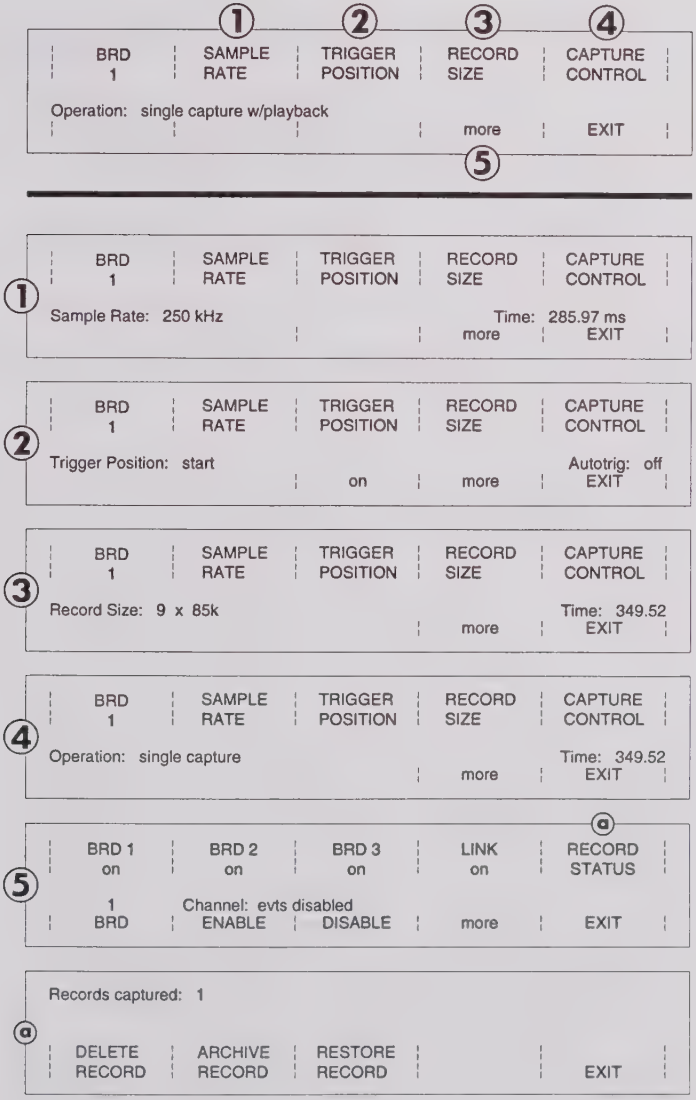
The data-capture menus of the "SETUP CAPTURE" parameter are shown on the next page.

NOTE

The data-capture setup parameters for each data-capture board are individually specified. The selections applied to one board do not apply to any other board.

If data-capture boards have been linked, via the LINK parameter, some but not all data-capture selections apply mutually to the linked boards.

Data-capture setups



Selecting a data-capture sample rate

When capturing and playing back data-capture records, the DASH 10 requires you to select a sample rate specified as a frequency in Hz or kHz.

The DASH 10 can sample data at any of fifteen data-capture sample rates. The fifteen available sample rates directly correspond to the playback timebases shown in the table on the next page.

In most cases, sampling data at a rate approximately 10 times faster than the highest waveform frequency provides excellent playback resolution.

sample rate	equivalent playback timebase
5 Hz	4 s/mm
10 Hz	2 s/mm
25 Hz	800 ms/mm
50 Hz	400 ms/mm
100 Hz	200 ms/mm
250 Hz	80 ms/mm
500 Hz	40 ms/mm
1 kHz	20 ms/mm
2.5 kHz	8 ms/mm
5 kHz	4 ms/mm
10 kHz	2 ms/mm
25 kHz	800 µs/mm
50 kHz	400 µs/mm
125 kHz	160 µs/mm
250 kHz	80 µs/mm

Selecting a data-capture sample rate

Use the procedure below to select a data-capture playback timebase that applies to all channels.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "SETUP CAPTURE."**

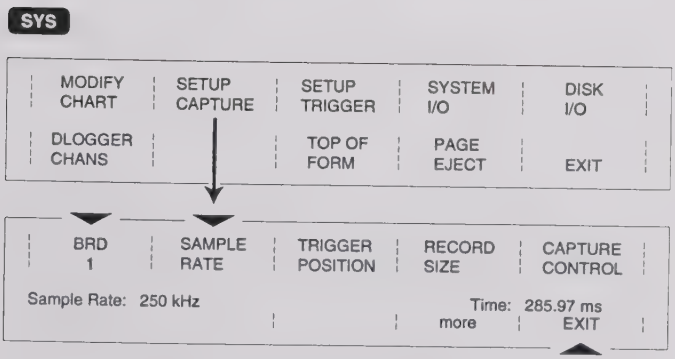
3 **Press the soft key above "BRD" until the data-capture board you want to setup is selected.**

4 **Press the soft key above "SAMPLE RATE."**

5 **Use the encoder wheel to select the sample rate that you want.**

- **Note that, as sample rates are selected, the "Time:" parameter of the display dynamically changes to show how much time the data capture will require.**
- **The time required to complete a data capture is a function of the sample rate selected and the record size selected.**

6 **Press the soft key below "EXIT" to leave the "SAMPLE RATE" menu.**



Selecting a data-capture record size

When capturing data with the DASH 10, the terms "record size" and "window size" mean the same thing. "Record size" and "window size" indicate, in kilosamples per record per channel, the total amount of data capture memory allocated to the next data-capture record.

The "RECORD SIZE" selection of the "SETUP CAPTURE" parameter is used to select the size of the next data-capture record. The record size that you select applies to all recording channels on the selected data capture board.

Use the procedure below to select a record size.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "SETUP CAPTURE."**

3 **Press the soft key above "BRD" until the data-capture board you want to setup is selected.**

4 **Press the soft key above "RECORD SIZE."**

5 **Use the encoder wheel to select the record size that you want.**

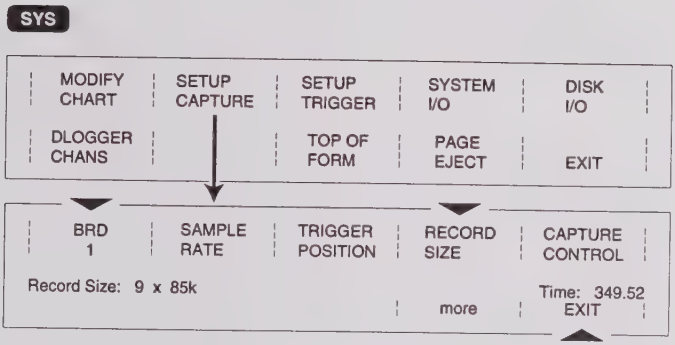
- **Note that, as record sizes are selected, the "Time:" parameter of the display dynamically changes to show how much time the data capture will require.**
- **The time required to complete a data capture is a function of the sample rate selected and the record size selected.**

6 **Press the soft key below "EXIT" to leave the "RECORD SIZE" menu.**

- **See the illustration at the top of the next page.**

8.3.2

Selecting a data-capture record size



8.3.3

The data-capture window and trigger placement

Data is captured with reference to a trigger. The term "trigger/window relationship" is used to describe the location of the trigger within the data-capture window. As with all data-capture setups, the trigger/window relationship has to be defined before data is captured. After a data-capture record has been created, the trigger/window relationship cannot be changed for that record.

The location of the trigger within the window determines the percentages of pretrigger and post-trigger data that are captured. The DASH 10 menus make it convenient to discuss the trigger/window relationship in terms of four trigger location possibilities. These are:

- start triggers
  - Start triggers place the trigger at the very beginning of the window. The only data captured is after the trigger.
- end triggers
  - End triggers place the trigger at the very end of the window. The only data captured is before the trigger.

The data-capture window and trigger placement

- center triggers
  - Center triggers place the trigger at the very middle of the window. 50% of the data captured is pretrigger and 50% of the data is post-trigger.
- percentage triggers
  - Percentage triggers are placed within the window at 1% increments. Pretrigger data and post-trigger data are captured with reference to where the trigger is placed.
- autotriggers
  - Autotriggers are start triggers that are generated immediately and automatically when the system is first armed.

Use the procedure below to place the trigger within the data-capture window.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "SETUP CAPTURE."**

3 **Press the soft key above "BRD" until the data-capture board you want to setup is selected.**

4 **Press the soft key above "TRIGGER POSITION."**

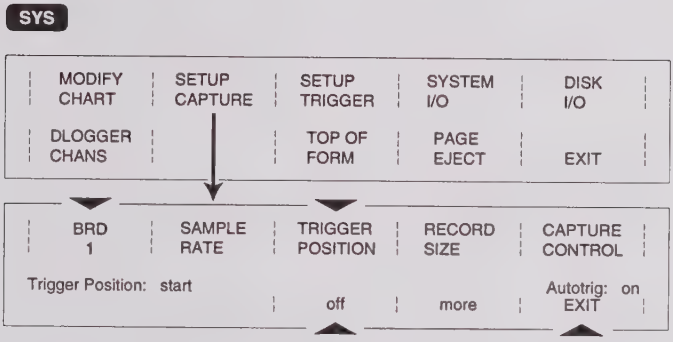
5 **Use the encoder wheel to select the percentage into the data-capture window that you want to place the trigger.**

6 **Press the soft key below "on" to enable the Autotrig function.**

- **When autotrig is turned on, a trigger is immediately and automatically generated when the system is first armed.**

The data-capture window and trigger placement

7 Press the soft key below "EXIT" to leave the "TRIGGER POSITION" menu.



As earlier mentioned, DASH 10 recorders equipped with data capture memory and software provide four data-capture methods:

- single capture

  upon arming the system, single records are acquired without data playback and without interrupting real-time recording. Acquisitions are individually added to the inventory of records in system memory.

- single capture w/playback.

  upon arming the system, single records are acquired. Playback immediately follows capture completion. Real-time recording is aborted during playback and the record is retained in the inventory of records in the system.

- multi-capture (stacking)

  multiple records are captured one after another. Playback is not automatic. Records are saved in memory for later manipulation.

8.3.3

The data-capture window and trigger placement

- continuous capture with playback.

  records are acquired, played back, and deleted and subsequent acquisitions are captured under the same record number. Records are not saved.

8.3.4

Selecting a data-capture method

The "CAPTURE CONTROL" selection of the "SETUP CAPTURE" parameter is used to select the data-capture method that you want to use.

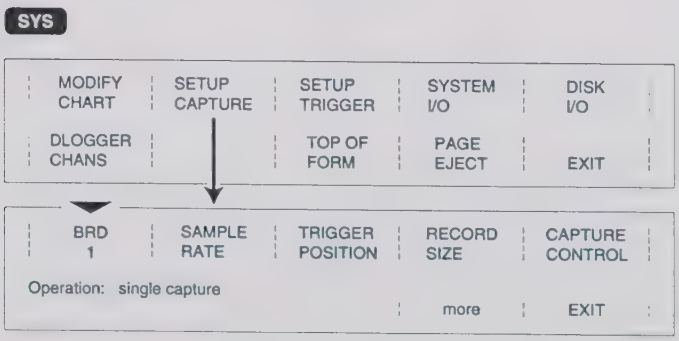
Use the procedure below to select either the "single capture" data-capture method or the "single capture with playback" data-capture method.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "SETUP CAPTURE."**

3 **Press the soft key above "CAPTURE CONTROL."**

4 **Press the soft key above "BRD" until the data-capture board you want to setup is selected.**

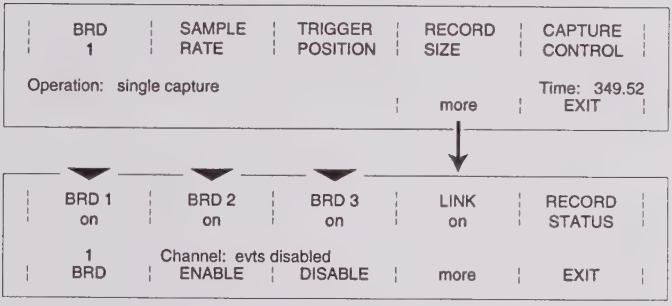


Selecting a data-capture method

5 **Press the soft key below "more."**

6 **Press the soft key above "BRD" to turn the board on or off for data-capture.**

- **If the recorder is equipped with multiple boards, each board will appear in the menu.**



7 **Use the encoder to select each specific channel that you want to enable or disable as a trigger source.**

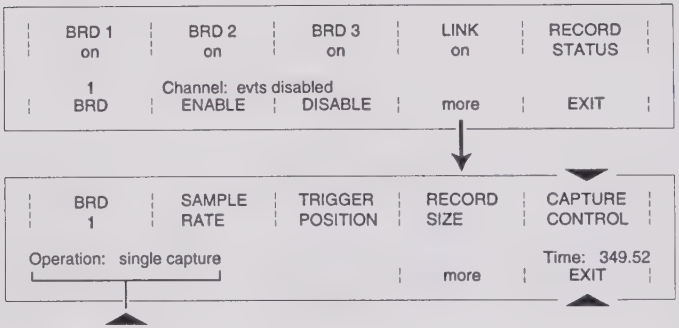
8 **Press the soft key beneath "ENABLE" or "DISABLE" to turn the selected channel on or off as a trigger source.**

Selecting a data-capture method

9 Press the soft key below "more.".

10 Press the soft key above "CAPTURE CONTROL."

11 Use the encoder wheel to select the data capture method that you want.



12 Press the soft key above "TRIGGER POSITION."

13 If you want to use the optional autotriggering function, press the soft key below "on/off" until the "Autotrig:" parameter shown in the display is set to "on."

14 Press the soft key above "EXIT" to leave the "TRIGGER POSITION" menu.

15 Press the front-panel [ARM] key and arm the system.

- The system is armed when the ARM indicator light next to the [ARM] key is illuminated.

Selecting a data-capture method

If "single capture" is the selected data capture method

- each capture is individually added to the next data capture record.
- the system must be manually re-armed after each capture.
- If the optional autotrigger function is turned on, a trigger is generated immediately and automatically when the system is first armed.

If "single capture w/playback" is the selected data capture method

- data is captured.
- a hard-copy of the captured data is printed immediately and automatically.
- real-time recording is aborted during data playback.
- each capture is individually added to the next data capture record.
- the system must be manually re-armed after each capture and playback.
- If the optional autotrigger function is turned on, a trigger is generated immediately and automatically when the system is first armed.

Selecting a data-capture method

If "multi-capture (stacking)" is the selected data capture method

- the system remains armed.
- data capture records are created automatically.
- records are consecutively "stacked."
- the system rearms itself at the completion of each acquisition and stacking.
- If the optional autotrigger function is turned on, a trigger is generated immediately and automatically when the system is first armed.

If "continuous capture w/playback" is the selected data capture method

- data is acquired to the next available record.
- the captured data is played back.
- the captured data is deleted.
- upon the next trigger:
  - the same record is filled with captured data.
  - the data is automatically played back and deleted.
  - this mode of operation continues until changed to any of the other data-capture methods.
- If the optional autotrigger function is turned on, a trigger is generated immediately and automatically when the system is first armed.

Linking multiple data-capture boards

When equipped with the data-capture capability, the DASH 10's waveform input signal boards each contain six megasamples of volatile memory for the storage of data capture records.

A DASH 10 with three analog waveform boards can be equipped with a maximum of eighteen megasamples of data-capture record storage.

In recorders with multiple data capture boards, the data-capture memory of each board is an independent resource. However, data-capture memory from seperate boards can be linked so that data-capture records from different boards can be printed in the same playback.

The LINK function found in the SETUP CAPTURE menus is used to link data-capture memory for playback.

Use the procedure below to link the memory resources of multiple data-capture boards.

1 **Ensure that the data-capture setups of each data-capture board to be linked are identical.**

- **These setups are sample rate, trigger position, record size, and the number of active channels.**
- **Linking will fail when attempted on boards that contain any differences in data-capture setups.**

2 **Press the front-panel [SYS] key.**

3 **Press the soft key above "SETUP CAPTURE."**

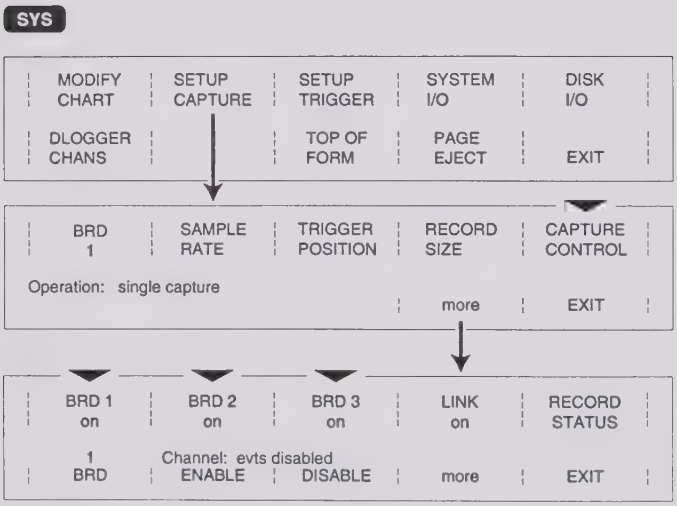
4 **Press the soft key above "CAPTURE CONTROL."**

5 **Press the soft key below "more."**

Linking multiple data-capture boards

5 **Ensure that each data-capture board that you want to link is turned on.**

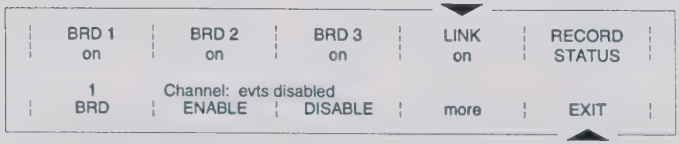
- **Press the soft key above the menu selection of each applicable "BRD" until the display reads "on."**



6 **Press the soft key above "LINK" until the display shows the parameter is "on."**

- **The memory capacity of each enabled data-capture board is automatically linked.**

7 **Press the soft key above "EXIT" to leave the "CAPTURE CONTROL" menu.**

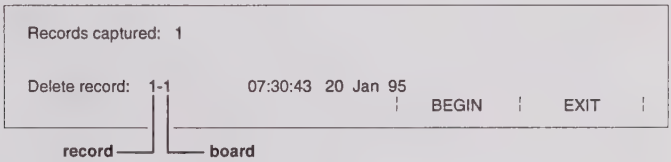


Data-capture record naming conventions

As previously explained, the DASH 10 can be equipped with a maximum of three data-capture boards. In DASH 10 systems containing multiple data-capture boards:

Board 1 (Brd1) always refers to recording channels 1-10.
Board 2 (Brd2) always refers to recording channels 11-20.
Board 3 (Brd3) always refers to recording channels 21-30.

The recorder displays seperate (unlinked) records in the generic form of: REC-BRD where REC is the record number and BRD is the data-capture board number. The following illustration is an example.



Linked records are displayed in the generic form of: REC-BRD, BRD, BRD where REC is the record number and BRD is each data-capture board number. The following illustration is an example.

Whether linked or unlinked, record numbers can be from 1 to 8 and data-capture board numbers can be either 1, 2, or 3.

Archiving data-capture records to diskette

Data that has been captured by the DASH 10 can be archived to diskette by using the "ARCHIVE RECORD" setups of the SETUP CAPTURE parameter.

NOTE

The smallest data-capture record created by the DASH 10 occupies 1.5MB. This means that a complete, single data-capture record will not be small enough to fit on a high-density 1.4MB diskette.

As a result, when a record is archived to diskette, you must select the part of the data that is of interest.

Four parameters must be defined when captured data is archived:

- MODIFY FILENAME
  - allows input or editing of a file name for the data-capture record.
- SET RECORD
  - selects the record to be archived and displays pertinent facts regarding the record.
- MODIFY WINDOW
  - selects all of the captured data or any specific portion of the data for achiving.
- SET CHANNEL
  - selects all of the captured channels or any specific channel for achiving.

Archiving data-capture records to diskette

Use the procedure below to archive data to diskette.

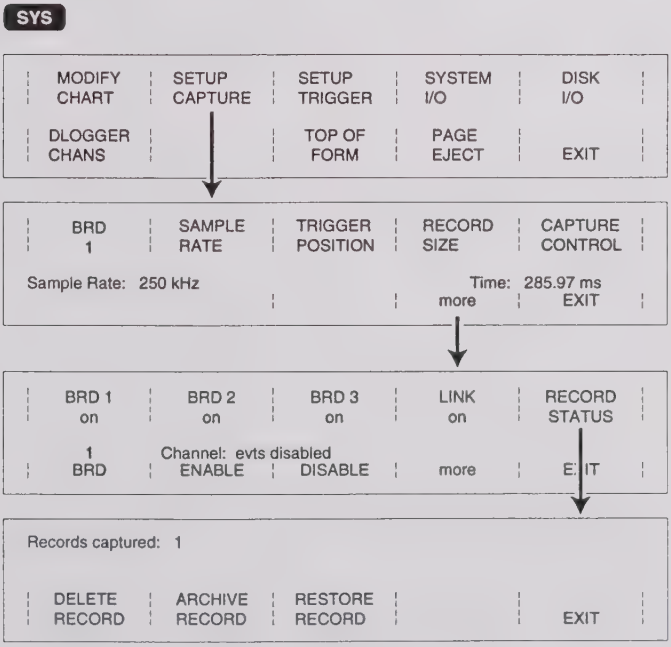
1 **Place a diskette in the front-panel disk drive.**

2 **Press the front-panel [SYS] key.**

3 **Press the soft key above "SETUP CAPTURE."**

4 **Press the soft key below "more."**

5 **Press the soft key above "RECORD STATUS."**



Archiving data-capture records to diskette

6 Press the soft key above "ARCHIVE RECORD."

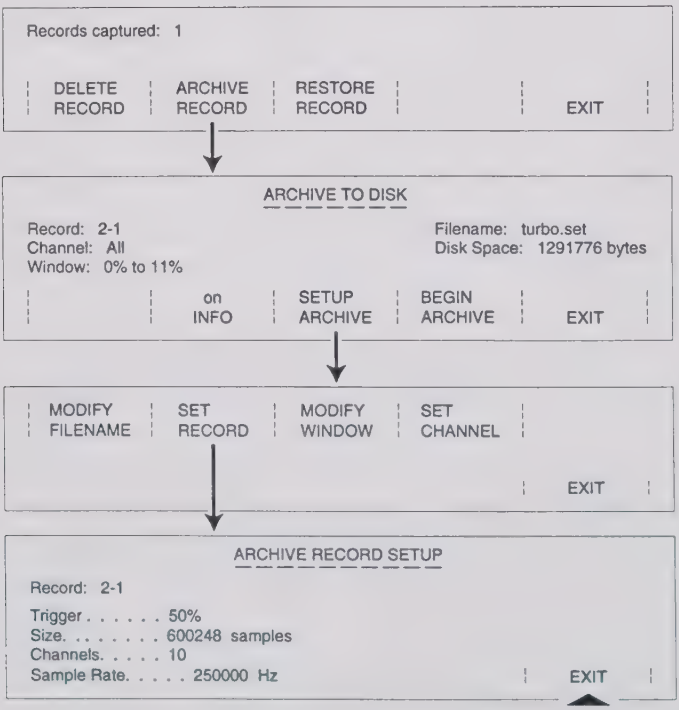
7 Press the soft key above "SETUP ARCHIVE."

8 Press the soft key above "SET RECORD."

- Note that a brief description of the record is shown in the display.

9 Use the encoder wheel to select the number of the record that you want to archive.

10 Press the soft key above "EXIT."

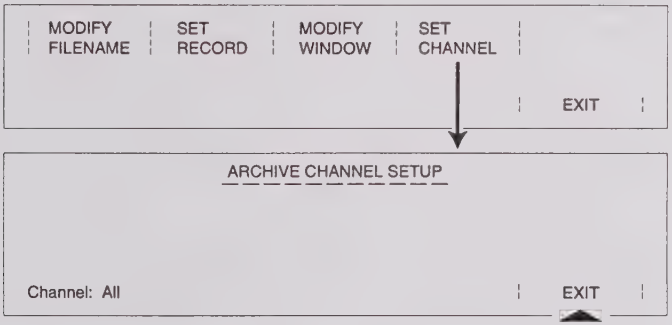


Archiving data-capture records to diskette

11 **Press the soft key above "SET CHANNEL."**

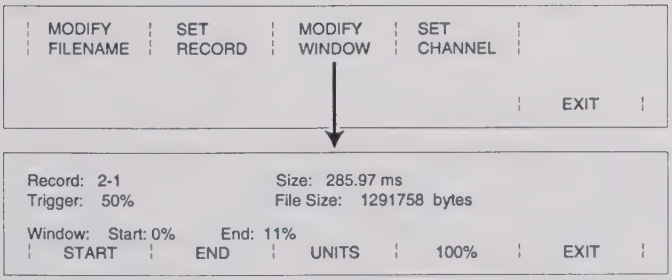
12 **Use the encoder wheel to select either all the channels or the specific channel that you want to archive.**

13 **Press the soft key below "EXIT."**



14 **Press the soft key above "MODIFY WINDOW."**

- **Note that the "MODIFY WINDOW" menu shows the following information:**
  - **the number of the selected record.**
  - **the position of the trigger within the data capture window expressed as a percentage.**
  - **the size of the data-capture window shown as start and end points.**

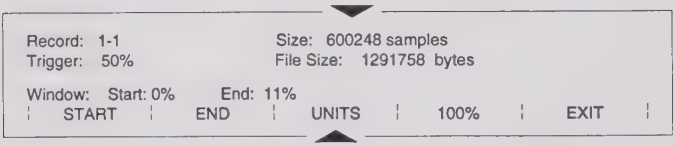


Archiving data-capture records to diskette

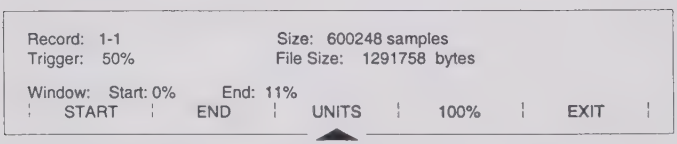
15 Press the soft key below "UNITS" to select the units in which the data capture window will be described.

- The DASH 10 can describe the data capture window in units of time:

- quantity of data samples:



- or percentage of window:



16 If you want to use the entire memory capacity of the diskette for the archive, press the soft key below "100%."

- Be aware that the smallest record that the recorder creates (1.536 megabytes) will not fit completely on a high-density diskette (1.4 megabytes).

- As a result, it is necessary to adjust the data-capture window to fit the storage capacity of the diskette.

- See the illustration on the next page.

Archiving data-capture records to diskette

17 **Press the soft key above "EXIT."**

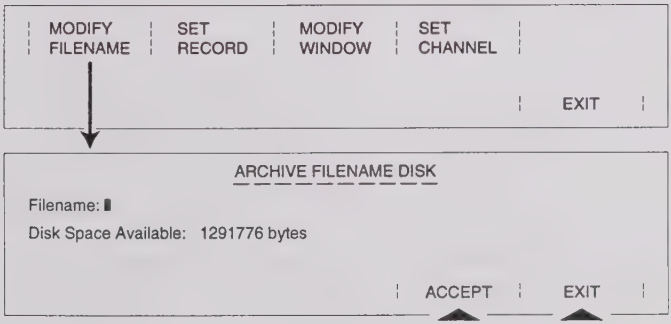
18 **Press the soft key above "MODIFY FILENAME."**

19 **Use the encoder wheel to select the file name of the record that you are archiving to diskette.**

20 **Use the keypad to edit or retype the file name.**

21 **Press the soft key below "ACCEPT."**

22 **Press the soft key below "EXIT."**



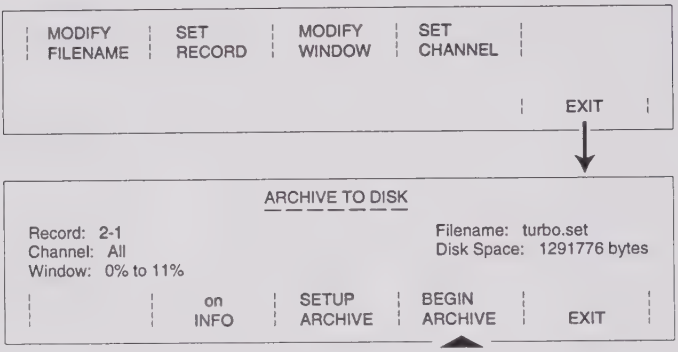
23 **Again, press the soft key below "EXIT."**

24 **Press the soft key below "BEGIN ARCHIVE."**

- **The record is immediately archived to diskette.**
- **Note that the archive menu is dynamic and shows the progress of the archiving process.**
- **See the illustration at the top of the next page.**

8.3.7

Archiving data-capture records to diskette



8.3.8

Deleting data-capture records from data-capture memory

Data-capture records can be deleted from data-capture memory by using the "DELETE RECORD" setup of the SETUP CAPTURE parameter.

Deleting data-capture records from data-capture memory is a function that is not related to deleting files from diskette. To delete files from diskette, refer to section 10 (Diskette-based input/output). See page 10-9.

Use the procedure below to delete a data-capture record from nonvolatile system memory.

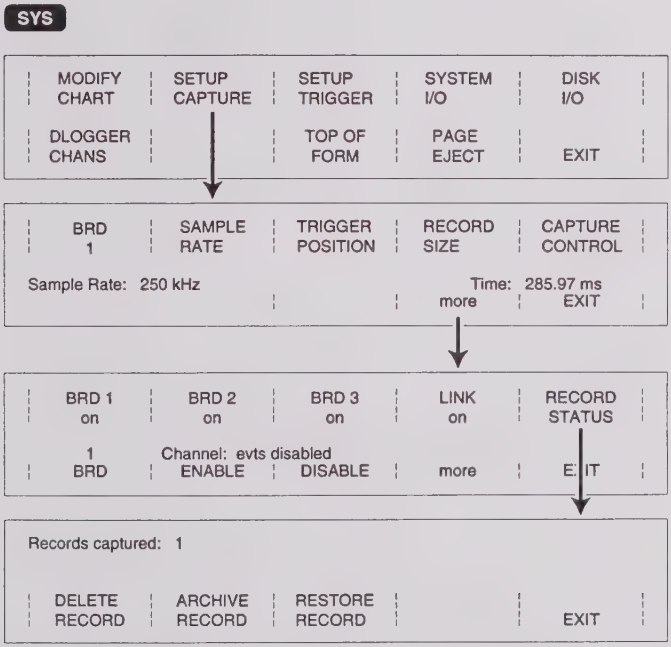
1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "SETUP CAPTURE."**

3 **Press the soft key below "more."**

Deleting data-capture records from data-capture memory

4 **Press the soft key above "RECORD STATUS."**



5 **Press the soft key below "DELETE RECORD."**

6 **Use the encoder wheel to select the number of the data-capture record that you want to delete.**

7 **Press the soft key below "BEGIN."**

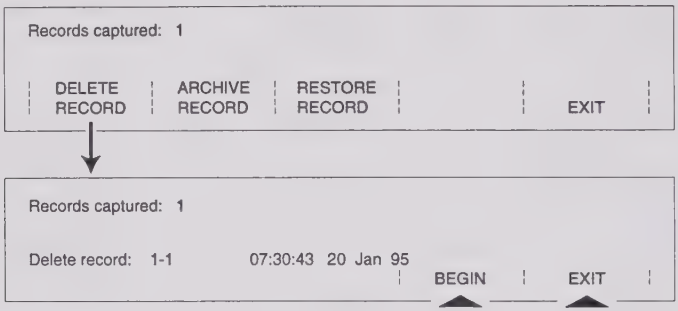
- **The record is immediately deleted from system memory.**

8 **Press the soft key below "EXIT."**

- **See the illustration at the top of the next page.**

8.3.8

Deleting data-capture records from data-capture memory



8.3.9

Restoring data-capture records from diskette to data-capture memory

Data-capture records that have been stored on diskette can be uploaded into the DASH 10's data-capture memory by using the "RESTORE RECORD" setup of the SETUP CAPTURE parameter.

Restoring data-capture records to data-capture memory is a function that is not related to restoring setups from diskette. To restore setups from diskette, refer to section 10 (Diskette-based input/output). See pages 10-5 and 10-6.

Use the procedure delete a data-capture record from nonvolatile system memory.

1 **Press the front-panel [SYS] key.**

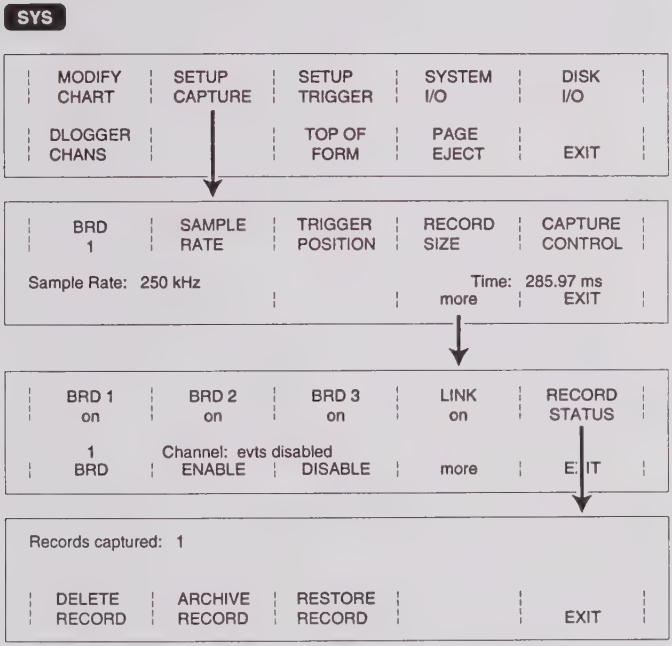
2 **Press the soft key above "SETUP CAPTURE."**

3 **Press the soft key below "more."**

4 **Press the soft key above "RECORD STATUS."**

- **See the illustration at the top of the next page.**

Restoring data-capture records from diskette to data-capture memory



5 Press the soft key below "RESTORE RECORD."

6 Use the encoder wheel to select the number of the data-capture record that you want to delete.

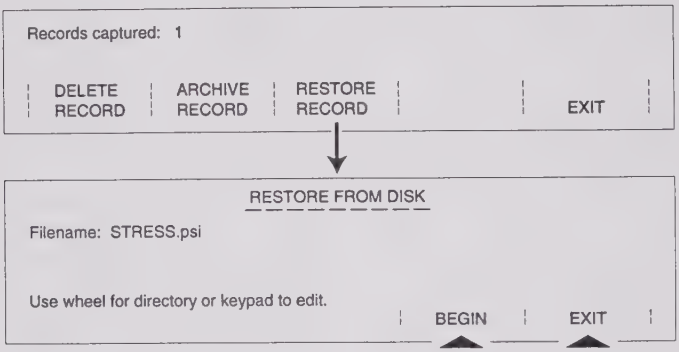
7 Press the soft key below "BEGIN."

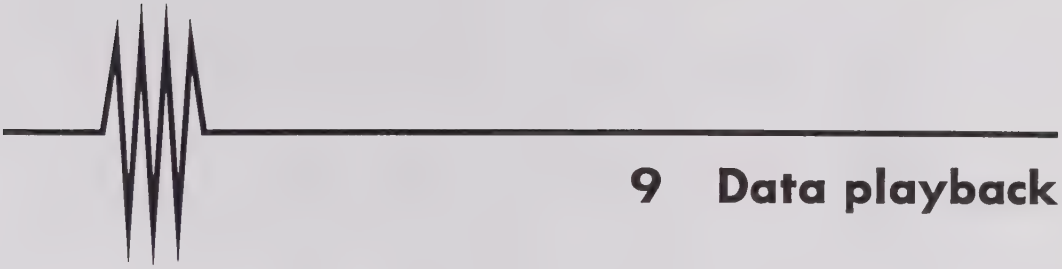
- The record is immediately restored to system memory from the diskette.

8 Press the soft key below "EXIT."

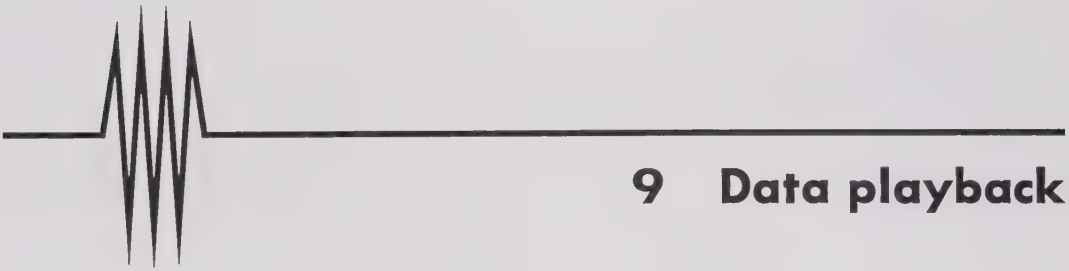
- See the illustration at the top of the next page.

Restoring data-capture records from diskette to data-capture memory





9 Data playback



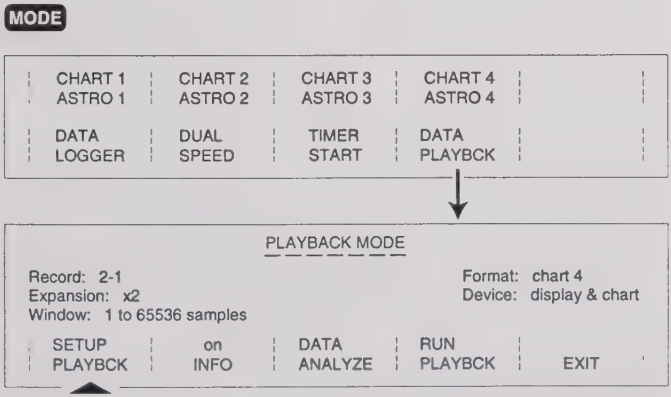
9 Data playback

Playing back data with the DASH 10

After capturing data you will want to replay the data for examination and analysis. The DASH 10 provides playback controls that allow you to:

- select for playback all the captured data in the record.
- select for playback any portion of the captured data of interest down to the level of individual samples.
- playback the captured data as:
  - hardcopy only.
  - hardcopy with simultaneous playback on the recorder's display.
  - playback to the front-panel display only.

When the DASH 10's front-panel [MODE] key is pressed, the data playback setups are found under the "SETUP PLAYBCK" parameter of the "DATA PLAYBCK" mode.

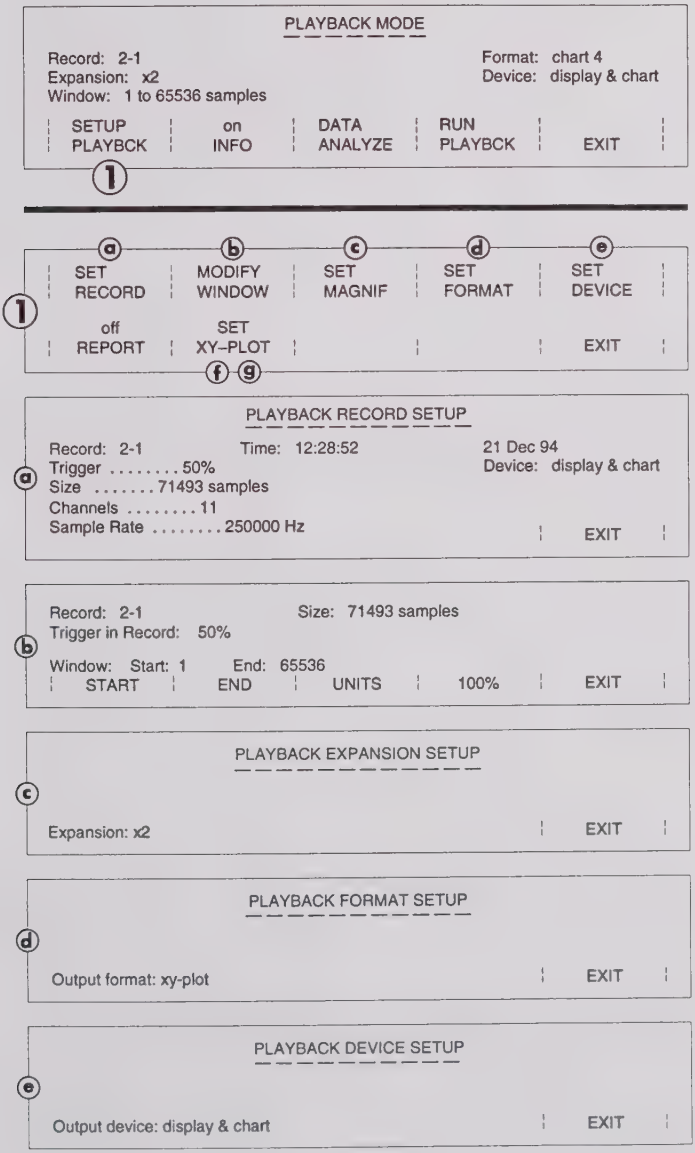


Playing back data with the DASH 10

"SETUP PLAYBCK" parameters include:

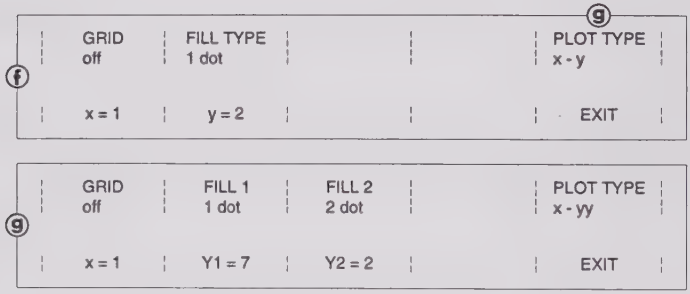
- SET RECORD
  - selects the data-capture record of interest and provides the following information regarding the selected record: trigger placement, size, number of channels, and sample rate.
- MODIFY WINDOW
  - selects all of the captured data or any specific portion of the data for playback.
- SET MAGNIF
  - expands or compresses the playback to allow detailed examination of data or to obtain an overview of the data.
- SET FORMAT
  - selects an output format that determines the "layout" of the captured data on the chart paper or on the front-panel display.
- SET DEVICE
  - selects as the playback destination either:
    - chart paper only.
    - chart paper and the front-panel display.
    - the front-panel display only.
- REPORT
  - generates a hardcopy report listing a variety of data including each channels full scale range, zero suppression status, DC/GND status, mode, and signal filtering status.
- SET XY - PLOT
  - selects channels to be plotted as XY or XYY graphs and specifies grid printing and plot fill options.

Playing back data with the DASH 10



9.1

Playing back data with the DASH 10



9.1.1

Selecting a data-capture record for playback

The "SET RECORD" parameter found under the "SETUP PLAYBCK" setup is used to select a data-capture record for playback. The "SET RECORD" parameter also displays the following information about the selected record: trigger placement, size, number of channels, and sample rate.

Use the procedure below to select a data-capture record for playback.

1 **Press the front-panel [MODE] key.**

2 **Press the soft key below "DATA PLAYBCK."**

3 **Press the soft key below "SETUP PLAYBCK."**

4 **Press the soft key above "SET RECORD."**

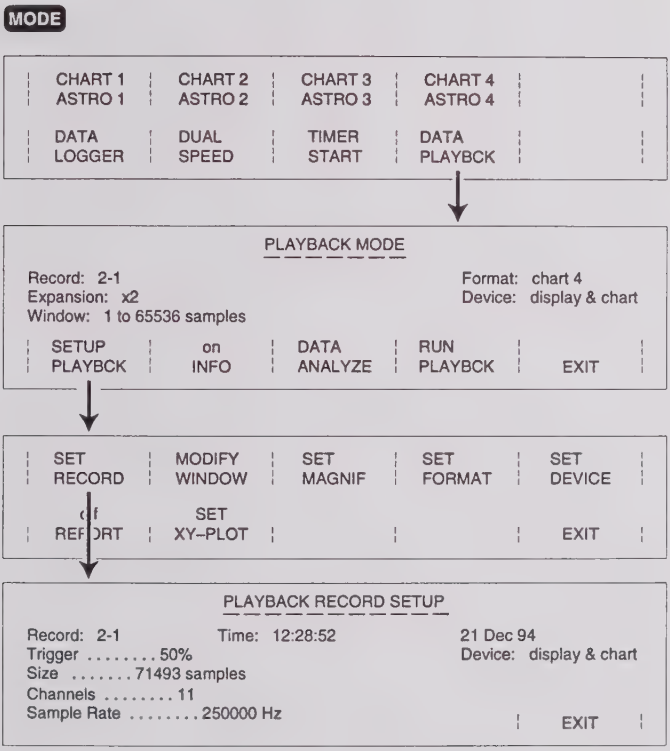
5 **Use the encoder wheel to select the data-capture record of interest.**

6 **Press the soft key below "EXIT" to leave the "SET RECORD" parameter.**

■ **See the illustration at the top of the next page.**

9.1.1

Selecting a data-capture record for playback



9.1.2

Selecting either the entire record or a specific part of the record for playback

The "MODIFY WINDOW" parameter found under the "DATA PLAYBCK" setup is used to select either the whole data-capture record or any part of the record for playback.

Selecting either the entire record or a specific part of the record for playback

Use the procedure below to select the data you want to playback.

1 Select a data-capture record for playback as described in section 9.1.1.

2 Press the front-panel [MODE] key.

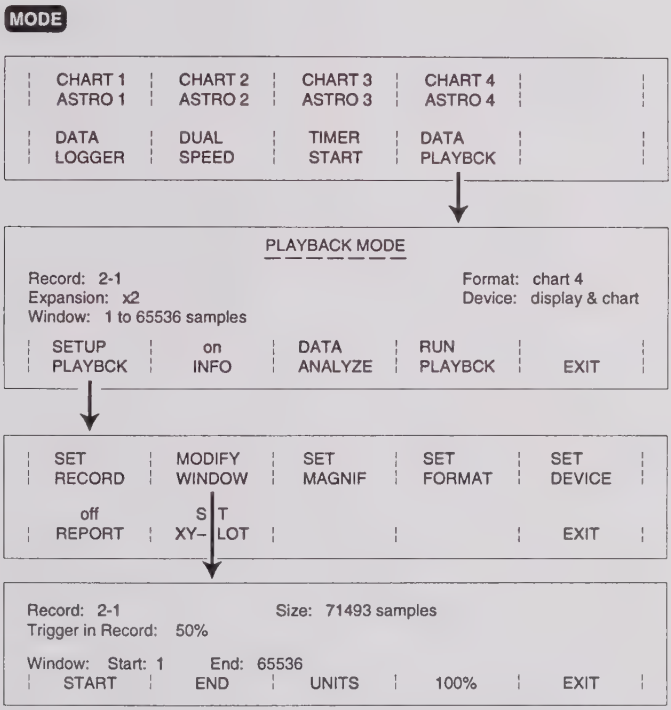
3 Press the soft key below "DATA PLAYBCK."

4 Press the soft key below "SETUP PLAYBCK."

5 Press the soft key above "MODIFY WINDOW."

- Note that the "MODIFY WINDOW" menu shows the following information:
  - the number of the selected record.
  - the position of the trigger within the data capture window expressed as a percentage.
  - the size of the data-capture window shown as start and end points.
- See the illustration on the next page.

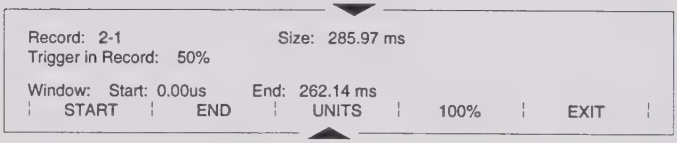
Selecting either the entire record or a specific part of the record for playback



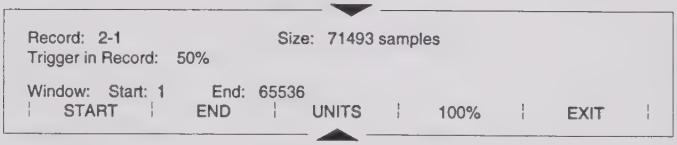
Selecting either the entire record or a specific part of the record for playback

6 **Press the soft key below "UNITS" to select the units in which the data capture window will be described.**

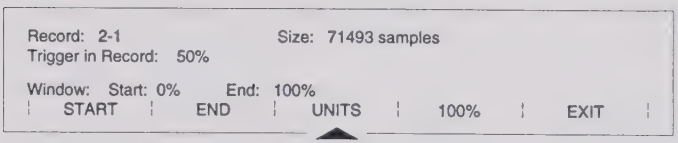
- **The DASH 10 can describe the data capture window in units of time:**



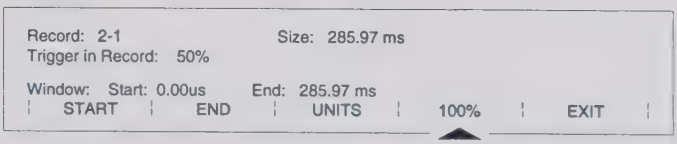
- **quantity of data samples:**



- **or percentage of window:**



7 **If you want to quickly select the entire data-capture window for replay, press the soft key below "100%."**



9.1.2

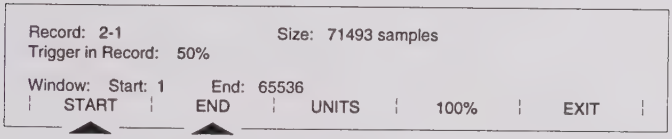
Selecting either the entire record or a specific part of the record for playback

8 **Press the soft key below "START."**

9 **Use the encoder wheel to select, from any location within the window, the starting point of the data to be played back.**

10 **Press the soft key below "END."**

11 **Use the encoder wheel to select, from any location within the window, the end point of the data to be played back.**



12 **Press the soft key below "EXIT" to leave the "MODIFY WINDOW" menu.**

9.1.3

Expanding or compressing a playback

Use the "SET MAGNIF" setup of the "SETUP PLAYBCK" parameter to expand or compress the playback of the captured data.

Expansion is used to examine data in detail. Compression is used to obtain an overview of the data.

Expanding or compressing a playback

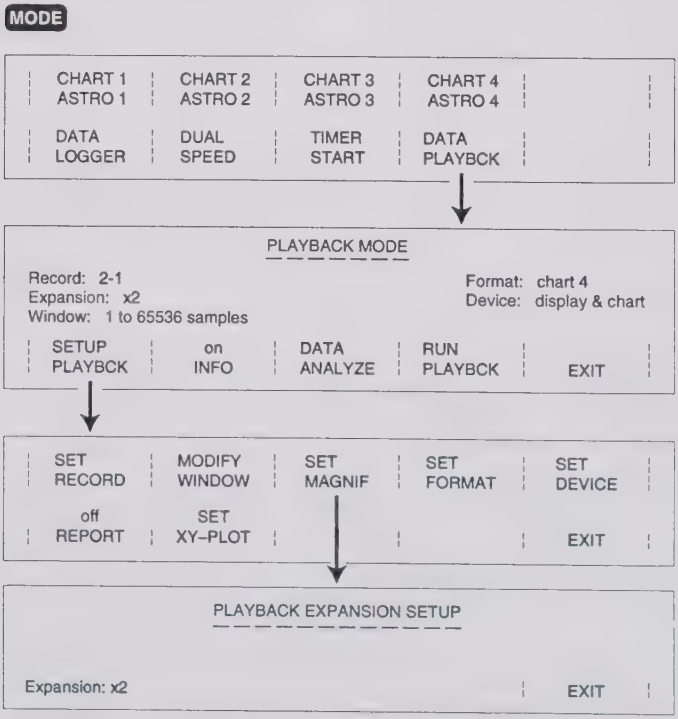
Use the procedure below to set the level of data expansion or compression you want for the playback.

1 **Press the front-panel [MODE] key.**

2 **Press the soft key below "DATA PLAYBCK."**

3 **Press the soft key below "SETUP PLAYBCK."**

4 **Press the soft key above "SET MAGNIF."**



9.1.3

Expanding or compressing a playback

5 **Use the encoder wheel to select the expansion factor that you want applied to the playback.**

- **expansion factors: x $^1/_2$, x $^1/_3$, x $^1/_4$ through x $^1/_{25}$ and x1, x2, x3 through x25.**

6 **Press the soft key below "EXIT" to leave the "SET MAGNIF" setup.**

9.1.4

Selecting a chart format for the playback

When playing back captured data, it is important to understand that the only chart formats that will be available for the playback will be those of the active recorder setup.

- Unless data playback is immediate or the active setup remains unchanged, it is possible for the chart formats of the current active setup to be unrelated to, or inappropriate for, the captured data being played back.
  - For example, if the data-capture record contains four channels but the chart formats of the active setup are for two channels then no sensible relationship would exist between the data being played back and the available chart formats.

Selecting a chart format for the playback

There are three solutions to this situation:

- When the data capture occurs, save the currently active setup with the data-capture record. When you are ready to play back the data-capture record, download the saved recorder setup so that the saved recorder setup becomes the active setup. This will ensure an appropriate correlation between the captured data and the chart format.
- When the data capture occurs, note the formats of the active setup so that you can reconstruct the recorder setup when the data-capture record is played back.
- Configure the appropriate recorder setup "from scratch" so that the available chart formats will be appropriate for playback of the data-capture record.

Use the procedure below to select the chart format on which the captured data will be replayed.

1 **Press the front-panel [MODE] key.**

2 **Press the soft key below "DATA PLAYBCK."**

3 **Press the soft key below "SETUP PLAYBCK."**

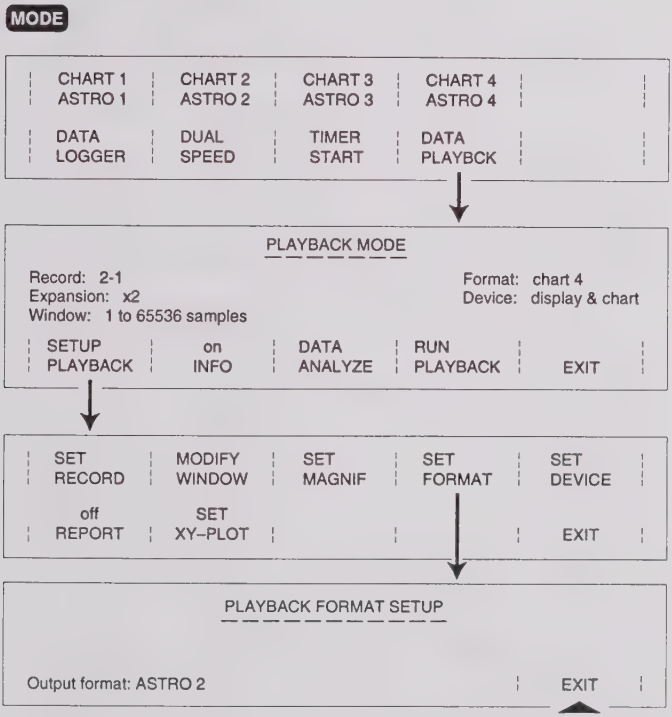
4 **Press the soft key above "SET FORMAT."**

5 **Use the encoder wheel to select the chart format that you want to use for the playback.**

- **You will be able to select either:**
  - **one of the four charts formats of the active recorder setup.**
  - **an XY or XYY plot.**
  - **an numeric playout of data logger channels.**

Selecting a chart format for the playback

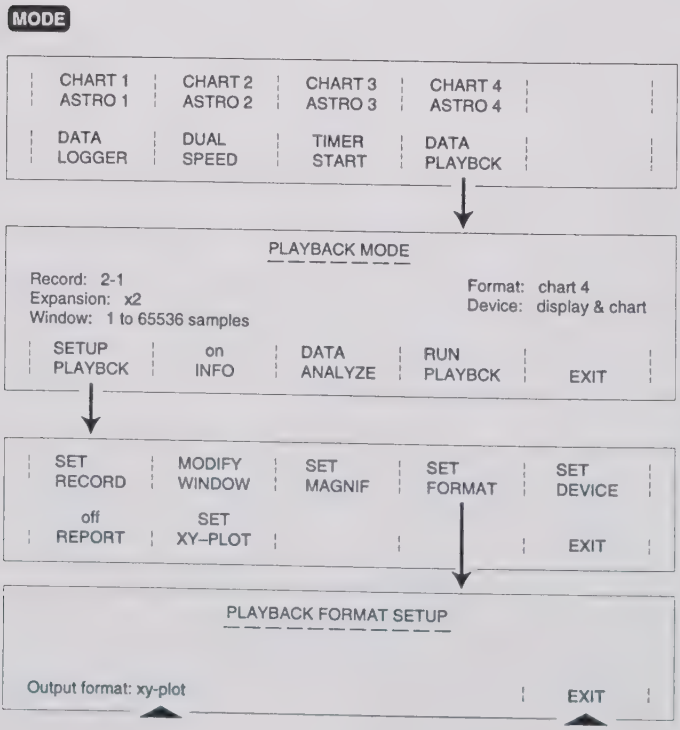
6 Press the soft key below "EXIT" to leave the SET FORMAT menu.



Setting up an XY plot

Use the procedure below to setup an XY-plot of captured data.

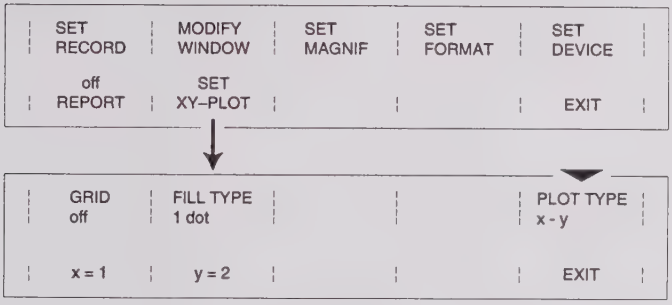
1. **Press the front-panel [MODE] key.**
2. **Press the soft key below "DATA PLAYBCK."**
3. **Press the soft key below "SETUP PLAYBCK."**
4. **Press the soft key above "SET FORMAT."**
5. **Use the encoder wheel to select the "xy-plot" chart format.**
6. **Press the soft key below "EXIT" to leave the SET FORMAT menu.**



Setting up an XY plot

7 **Press the soft key below "SET XY-PLOT."**

8 **Press the soft key above "PLOT TYPE" and select either X-Y or XYY.**



- **if you select an "x-y" plot type, the following display is shown.**

- **if you select an "x-yy" plot type, the following display is shown.**

Setting up an XY plot

9 Press the soft key below the **X** field and use the encoder wheel to select the channel you want plotted as the x-axis.

10 Press the soft key above "**FILL TYPE**" until the fill type you want to use with the x-axis is selected.

- Fill type is a description of how the **XY** or **XYY** data will be drawn when it is plotted.
  - Fill types include 1 dot, 2 dot, 3 dot, 4 dot, 5 dot, and line.
  - A 1-dot fill type plots each data point as a single printhead dot.
  - Fill types that use a greater number of dots (2-5 dots) thicken the appearance of the plotted data.
  - A fill type of "line" plots each data point and then connects each point to form a line.

11 Press the soft key below the **Y** field or fields and use the encoder wheel to select the channel or channels you want plotted as the y-axis.

12 Press the soft key above "**FILL TYPE**" until the fill type you want to use with the y-axis is selected.

9.1.5

Setting up an XY plot

11 **Press the soft key above "GRID."**

- **print a grid for the plot by setting the grid to "on."**
- **disable grid printing by setting the grid to "off."**

12 **Press the soft key below "EXIT" to leave the SET XY-PLOT menu.**

9.1.6

Selecting a destination for the playback

The DASH 10 allows you to playback the data-capture record to any of the following:

- chart paper only.
- chart paper and the front-panel display.
- the front-panel display only.

Use the procedure below to select the destination to which the data-capture record replayed.

1 **Press the front-panel [MODE] key.**

2 **Press the soft key below "DATA PLAYBACK."**

3 **Press the soft key below "SETUP PLAYBACK."**

4 **Press the soft key above "SET DEVICE."**

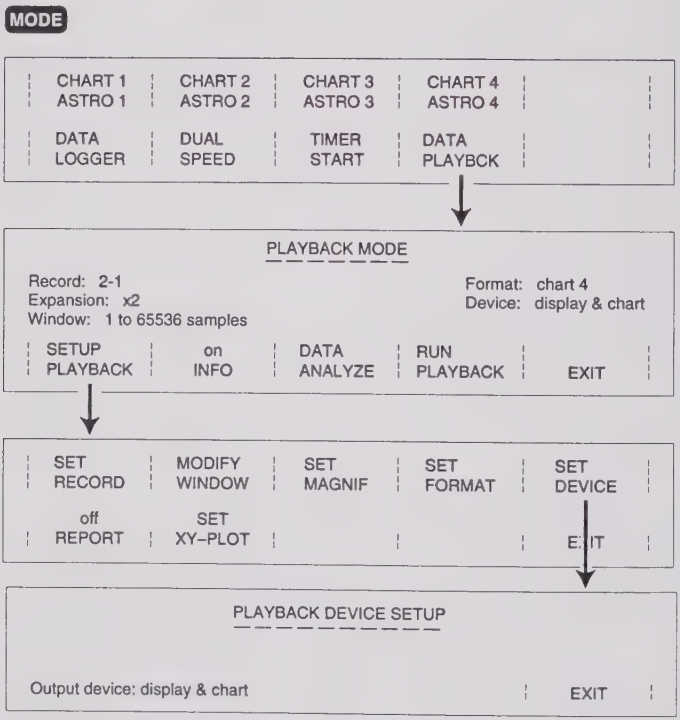
5 **Use the encoder wheel to select the playback destination that you want.**

6 **Press the soft key below "EXIT" to leave the "SET DEVICE" menu.**

- **See the illustration on the next page.**

9.1.6

Selecting a destination for the playback



9.1.7

Running the playback

Depending on the playback destination that you have chosen, captured data will be played back on chart paper only, on chart paper and the front-panel display, or only on the front-panel display. Use the procedure on the following page to run the playback to the destination that you have selected.

Running the playback

1 Press the front-panel [MODE] key.

2 As described in pages 9-2 through 9-19 of this manual, setup a data-capture playback by defining each of the parameters of the "SETUP PLAYBCK" mode.

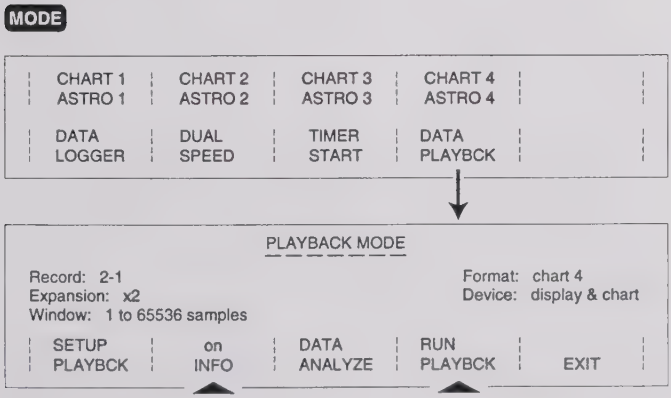
3 Press the soft key below "DATA PLYBCK."

4 Press the soft key below "INFO" until the parameter is turned on.

- A summary of information regarding the selected data-capture record is shown in the display.

5 Press the soft key below "RUN PLAYBCK."

- The record is played back to the output device that you have selected.



9.2

Plotting a data-capture record as a fast Fourier transform (FFT)

Fourier analysis is a kind of spectral analysis. It is used to break down complex waveforms into their constituent harmonic frequencies.

Technically, Fourier analysis is defined as the expansion of a mathematical function or of an experimentally obtained curve in the form of a trigonometric series. With specific reference to the DASH 10, Fourier analysis is used to determine the harmonic components of complex periodic waves.

Classical Fourier analysis requires intensive computation. As a result, mathematicians have developed a number of alternative approaches to performing Fourier analysis. One of the most common approaches (and the approach used in the DASH 10) is a mathematical technique called the fast Fourier transform (FFT).

■ The intent of the DASH 10's FFT capability

The DASH 10 offers a basic but extremely fast and useful FFT capability. The DASH 10's FFT capability is intended to provide a convenient means for screening waveform data to identify areas of interest and is not intended to function as an exhaustive analytical tool.

Traditional Fourier analysis assumes that the waveform under study is continuous, periodic, and infinite. The practical use of the FFT almost always violates these assumptions. Because the waveform under analysis is not generally an infinitely periodic waveform, a degree of distortion is introduced into the spectrum that results from the FFT process. The frequency axis of the recorder's FFT is very accurate. The amplitude axis is less accurate because, as just described, practical use of the FFT necessarily violates Fourier's theoretical ideal.

If you need greater accuracy than that provided by the DASH 10, you can transfer your data to a computer or workstation that has sufficient computational power and more sophisticated spectrographic algorithms.

Plotting a data-capture record as a fast Fourier transform (FFT)

■ Using the DASH 10's FFT capability

The DASH 10 can generate a frequency spectrum from any captured waveform. The frequency spectrum is printed in a format resembling an X-Y plot.

You select the data-capture record to be analyzed, the waveform channel of interest, and the section of the waveform to be analyzed. The FFT method (Cooley-Tukey) used in the DASH 10 always analyzes 1024 sample points.

The result of the DASH 10's FFT process is a plot of amplitude versus frequency. Output is scaled to the maximum amplitude with the result that Y-axis units are relative. The X-axis represents frequency with the range determined by the sample rate. An example of an FFT plot is provided on page 19-11.

Notice that you have a choice of plotting either the waveform input or the FFT of the waveform input. This choice is extremely useful because it allows you to view the waveform input and, consequently, to select for Fourier analysis only that portion of the waveform input that you find of interest.

NOTE

In order to ensure the most accurate FFT analysis, it is desirable that the sample rate of the data-capture be at least two times the highest expected frequency component of the input. If the spectrum resulting from an FFT seems obviously inaccurate, the sample rate used during data capture may have been inadequate.

The FFT is available only as a hard copy plot. It cannot be displayed, saved on floppy disk, or transferred to a host.

Use of the DASH 10's "DATA ANALYZE" function is described in the paragraphs that follow.

Plotting the waveform input to select the data for an FFT

It is desirable for you to identify the specific portions of waveform data that you are interested in subjecting to Fourier analysis. The "DATA ANALYZE" parameter allows you to do exactly this by plotting all or any portion of the captured waveform data. You can then examine the hard-copy plot and determine those areas of waveform activity that you want to investigate further. Use the procedure below to plot the waveform input so that you can examine it before analyzing it.

1 **As described in pages 9-2 through 9-19 of this manual, setup a data-capture playback by defining each of the parameters of the "SETUP PLAYBCK" mode.**

2 **Press the front-panel [MODE] key.**

3 **Press the soft key below "DATA PLAYBCK."**

4 **Press the soft key below "INFO" until the parameter is turned on.**

- **A summary of information regarding the selected data-capture record is shown in the display.**

5 **Press the soft key below "DATA ANALYZE."**

6 **Use the encoder wheel to select the channel number of the waveform of interest.**

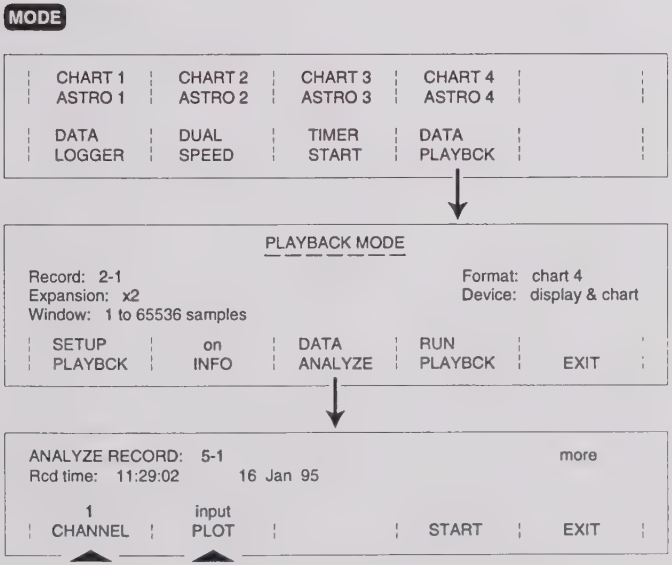
- **This is the "CHANNEL" selection in the display.**

7 **Press the soft key above "PLOT" and select "input."**

Plotting the waveform input to select the data for an FFT

8 Press the soft key below "START"

- The recorder immediately calculates and prints a hardcopy plot of the selected input.
- The printout is called a "DASH 10 DATA CAPTURE RECORD ANALYSIS."
- An example of an input-plot "DASH 10 DATA CAPTURE RECORD ANALYSIS" is shown on the next page.



Plotting the waveform input to select the data for an FFT

* * * DASH 10 CAPTURE RECORD ANALYSIS * * *
Record 1-1
Acquisition Time: Rcd time: 10 : 35 : 21 16 Jan 95
Sample rate: 250 kHz
Analysis Start Point: sample 1
Waveform Analyzed: 1
Plot Type: Input
Astro-Med, Inc.
204.8 us/div

waveform input plot

Performing Fourier analysis on selected data

After you have identified the portions of the captured waveform data that you want to subject to Fourier analysis, use the procedure below to have the DASH 10 automatically perform and plot the results of a fast Fourier transform.

1 **As described in section 9.2.1, select the waveform data that you want to plot as an FFT.**

2 **Press the front-panel [MODE] key.**

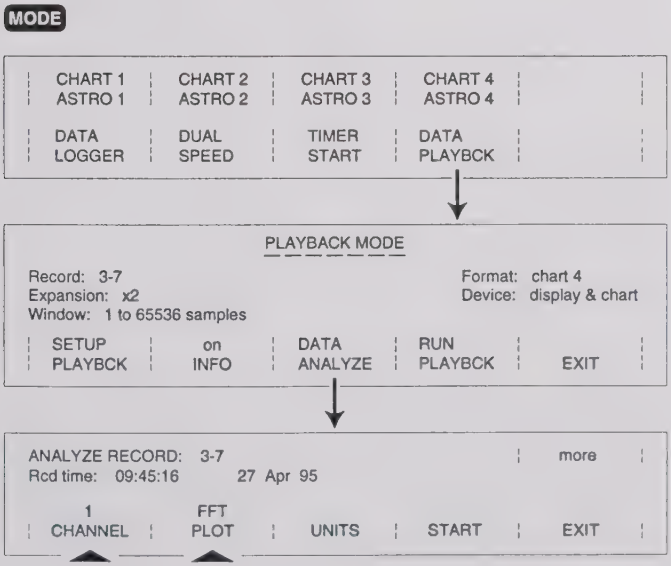
3 **Press the soft key below "DATA PLAYBCK."**

4 **Press the soft key below "DATA ANALYZE."**

5 **Use the encoder wheel to select the channel number of the waveform of interest.**

- **This is the "CHANNEL" selection in the display.**

6 **Press the soft key above "PLOT" and select "FFT."**



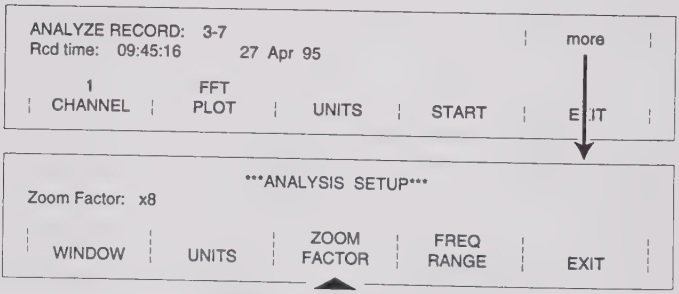
Performing Fourier analysis on selected data

6 Press the soft key above "more."

7 Press the soft key below "ZOOM FACTOR."

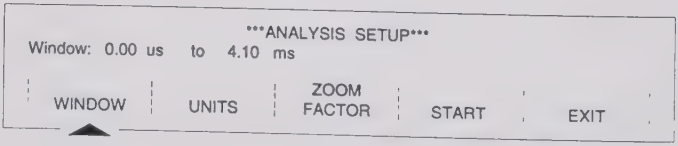
8 Use the encoder wheel to select an zoom (expansion) factor for the data that will be replayed.

- Zoom factors magnify the data that will be plotted.
- DASH 10 zoom factors are: 1, 2, 4, 8.



9 Press the soft key below "WINDOW."

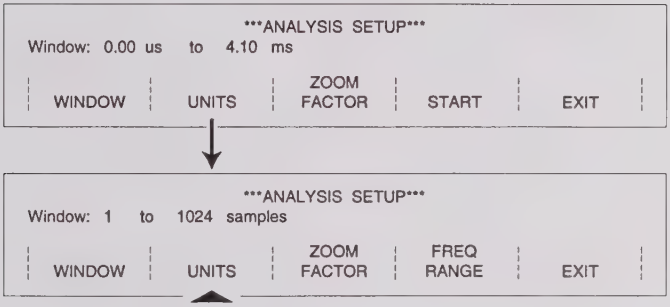
10 Use the encoder wheel to select the part of the data capture that will be plotted as an FFT.



Performing Fourier analysis on selected data

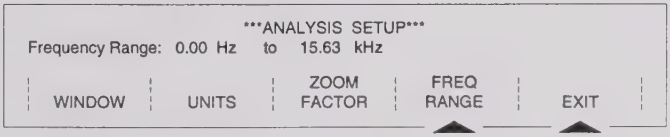
11 Press the soft key below "UNITS."

- **The display toggles between showing the data-capture window in units of time or number of samples.**



12 Press the soft key below "FREQ RANGE" if you want to define the data-capture window as a specific frequency span.

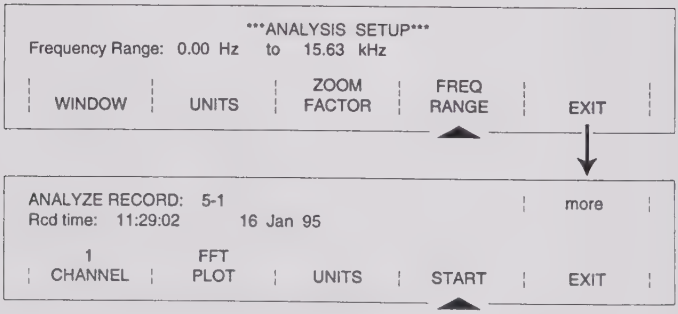
13 Press the soft key below "EXIT."



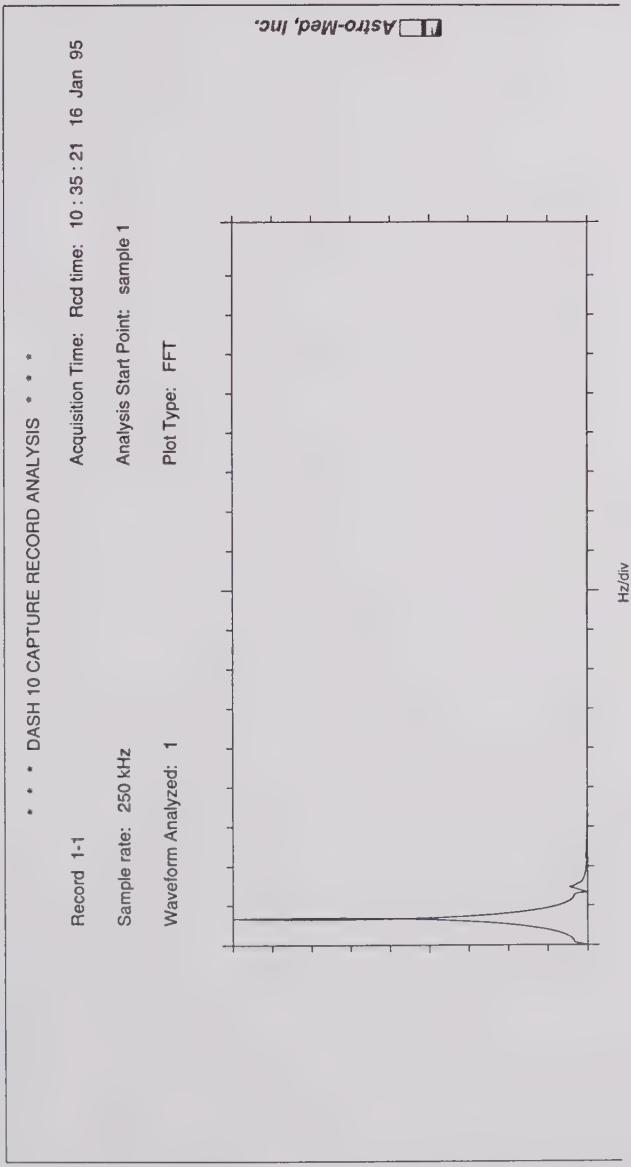
Performing Fourier analysis on selected data

14 **Press the soft key below "START"**

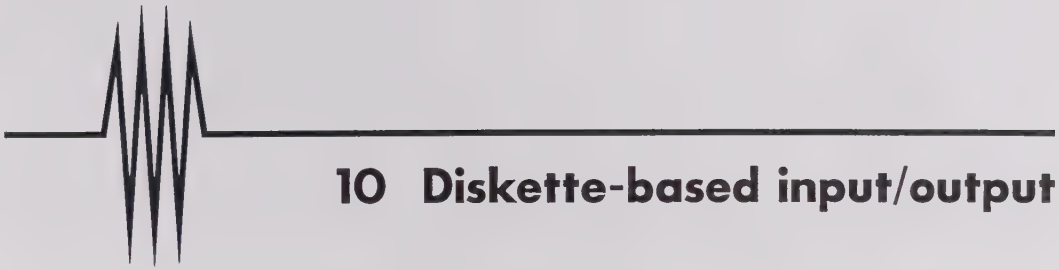
- **The recorder immediately calculates and prints a hardcopy plot of the FFT.**
- **The printout is called a "DASH 10 DATA CAPTURE RECORD ANALYSIS."**
- **An example of an FFT-plot "DASH 10 DATA CAPTURE RECORD ANALYSIS" is shown on page 9-29.**



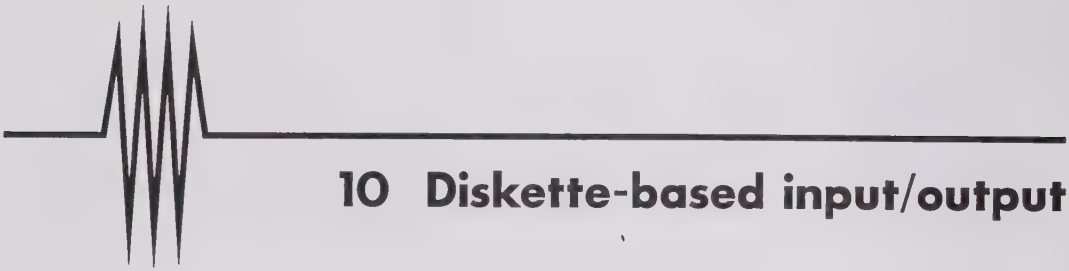
Performing Fourier analysis on selected data


Astro-Med, Inc.
* * * DASH 10 CAPTURE RECORD ANALYSIS * * *
Record 1-1
Acquisition Time: Rcd time: 10 : 35 : 21 16 Jan 95
Sample rate: 250 kHz
Analysis Start Point: sample 1
Waveform Analyzed: 1
Plot Type: FFT
Hz/div

FFT plot



10 Diskette-based input/output



10 Diskette-based input/output

Input/output functions when using diskettes

DASH 10 diskette-based input/output functions include:

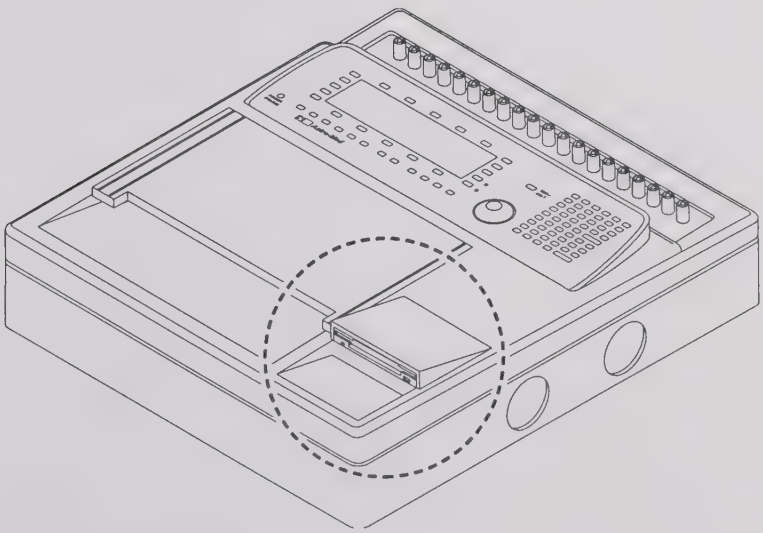
- saving almost all active recorder setups to diskette.
- recalling saved recorder setups from diskette.
- renaming files on diskette.
- deleting files from diskette.
- formatting diskettes.
- printing files from diskette.
- upgrading operating system software.*

*System software upgrades are discussed in section 11, System input/output.

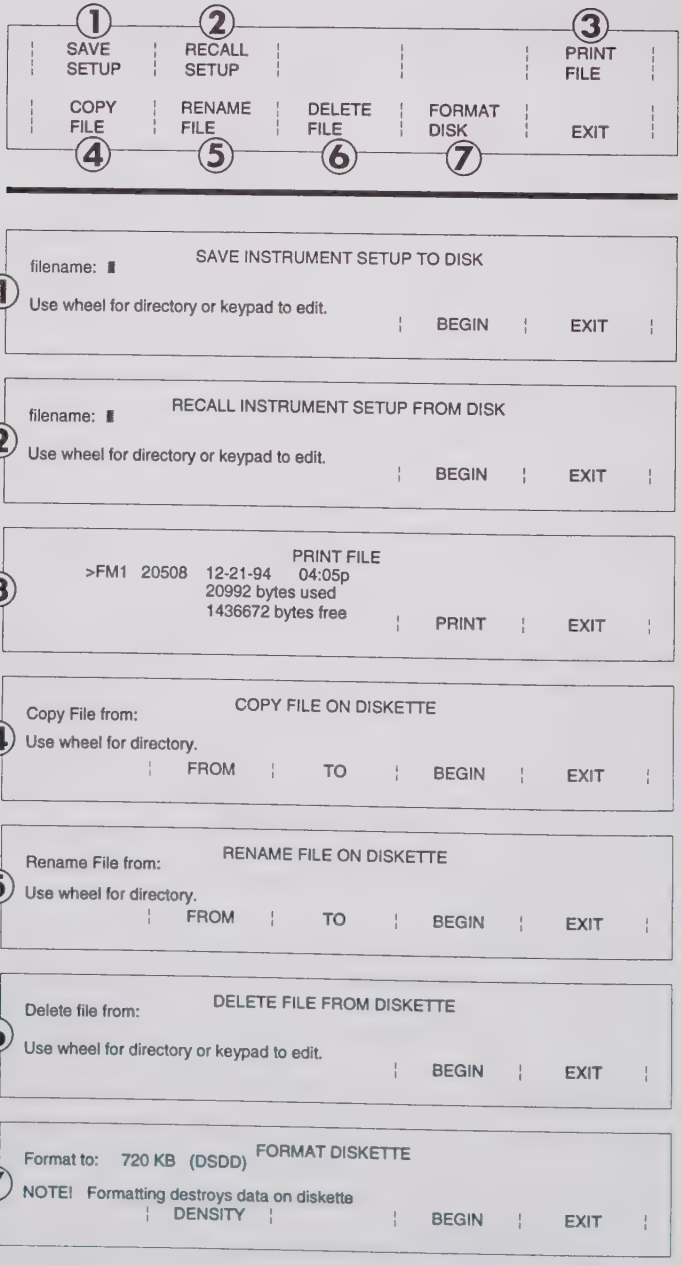
The procedures presented in this section describe how to define each of the DASH 10 system input/output functions.

The complete menu flow for the DISK I/O selection is shown on page 10-2.

Diskette-based input/output functions are done using the recorder's front-panel disk drive.



Input/output functions when using diskettes



10.2

About the settings that make a recorder setup

The DASH 10 has the ability to permanently save to diskette almost all active recording setups. This ability can be exceptionally useful because it completely eliminates the need for time-consuming, repetitive recorder preparation. Equally important, it allows you to create a "library" of recorder setups so that, whenever necessary, you can easily retrieve and reuse formats that have been previously setup.

When an active recorder setup is saved, the parameters that are saved are numerous and include:

- [Z/G] key settings.
- [EDIT] key settings.
- [SPD] key settings.
- MODIFY CHART settings.
- SETUP CAPTURE settings.
- SETUP TRIGGER settings.
- SYSTEM I/O settings.
- DATALOGGER recording mode settings.
- DUAL SPEED recording mode settings.
- TIMER START recording mode settings.
- DATA PLAYBCK settings.
- host control settings.

Setups are saved as a group in a named file so it is convenient to refer to saving all the recorder setups as saving "the setup."

The DASH 10's "SAVE SETUP" function is used when you want to save the setup selections of a recording session to diskette. The "SAVE SETUP" function is discussed in the paragraph that follows.

Saving a recorder setup to diskette

1 Put a formatted 3.5 inch diskette into the front-panel disk-drive.

- If necessary, use the FORMAT DISK procedure described in paragraph 10.7 of this section.

2 Press the front-panel [SYS] key.

3 Press the soft key above "DISK I/O."

4 Press the soft key above "SAVE SETUP."

5 Use the DASH 10's alphanumeric keypad to create a file name for the active recorder setup.

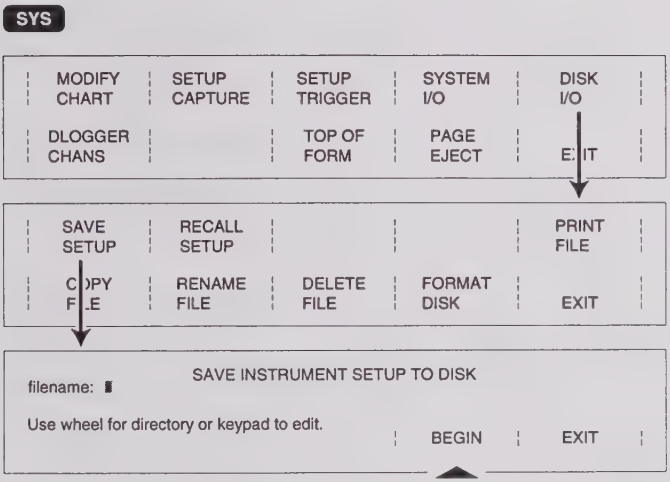
- The file name can be a maximum of twelve characters.
- Eight characters form the file name.
- Three characters are used to designate an extension.
- A dot separates the file name from the extension. For example, file names might look like: MYTEST12.dos, STRESSLB.dos, etc.
- If the diskette you are using already contains setup files, you can select any of the files and save the new recorder setup under the selected setup's name.

6 Press the soft key below "BEGIN."

- The active setup is saved to diskette under the file name you created or under an existing name.
- See the illustration at the top of the next page.

10.3

Saving a recorder setup to diskette



10.4

Recalling a recorder setup from diskette

When a saved recorder setup is recalled from diskette, the active recorder setup is lost and cannot be recovered. If you want to retain the active setup, always save it to diskette before recalling the saved setup.

1 **Put the diskette containing the saved recorder setup into the front-panel disk-drive.**

2 **Press the front-panel [SYS] key.**

3 **Press the soft key above "DISK I/O."**

4 **Press the soft key above "RECALL SETUP."**

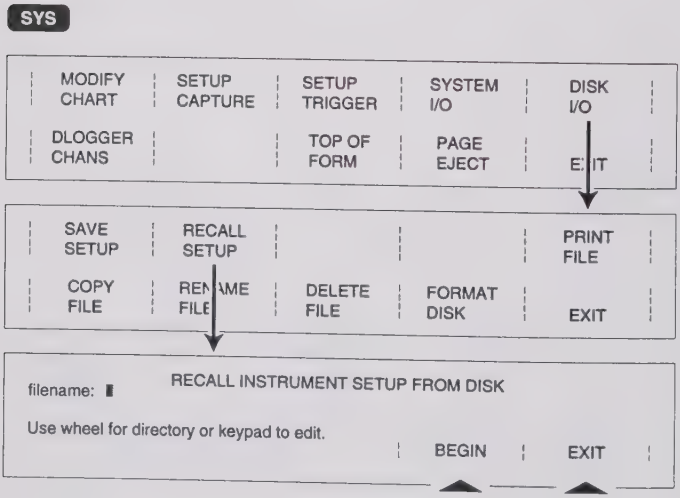
Recalling a recorder setup from diskette

5 **Use the encoder wheel to select the name of the saved recorder setup file that you want to upload from the diskette.**

6 **Press the soft key below "BEGIN."**

- **The selected recorder setup is recalled from diskette and becomes the active recorder setup.**

7 **Press the soft key below "EXIT" to leave the "RECALL SETUP" menu.**



Renaming files on diskette

Use the procedure on the procedure below to edit the name of any recorder setup file that you have saved to diskette.

1 **Put the diskette containing the saved recorder setup into the front-panel disk-drive.**

2 **Press the front-panel [SYS] key.**

3 **Press the soft key above "DISK I/O."**

4 **Press the soft key below "RENAME FILE."**

5 **Use the encoder wheel to select from the diskette the file name that you want to edit.**

6 **Press the soft key below "TO."**

7 **Use the DASH 10's alphanumeric keypad to type a new name for the selected file on diskette.**

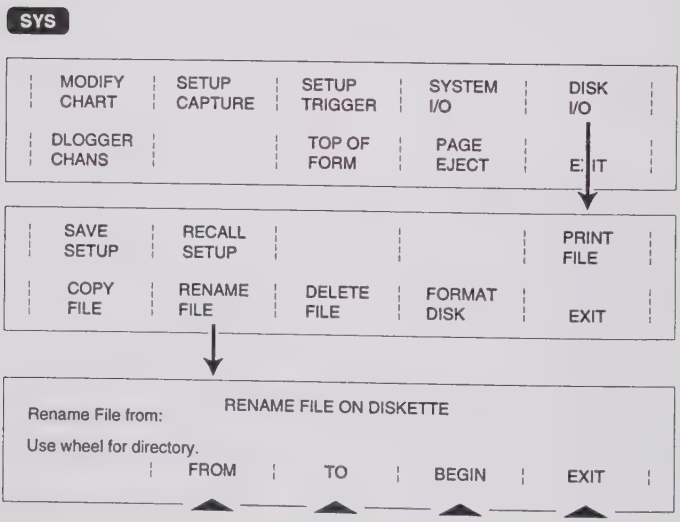
- **The length of the file name must be twelve characters.**
- **Eight characters form the file name.**
- **Three characters are used to designate an extension.**
- **A dot separates the file name from the extension.**

Renaming files on diskette

8 **Press the soft key below "BEGIN."**

- **The old file name is immediately replaced by the new name you just typed.**

9 **Press the soft key below "EXIT" to leave the "RENAME FILE" menu.**



Deleting files from diskette

Use the procedure on the procedure below to delete any recorder setup file that you have saved on a diskette.

1 **Put the diskette containing the saved recorder setup into the front-panel disk-drive.**

2 **Press the front-panel [SYS] key.**

3 **Press the soft key above "DISK I/O."**

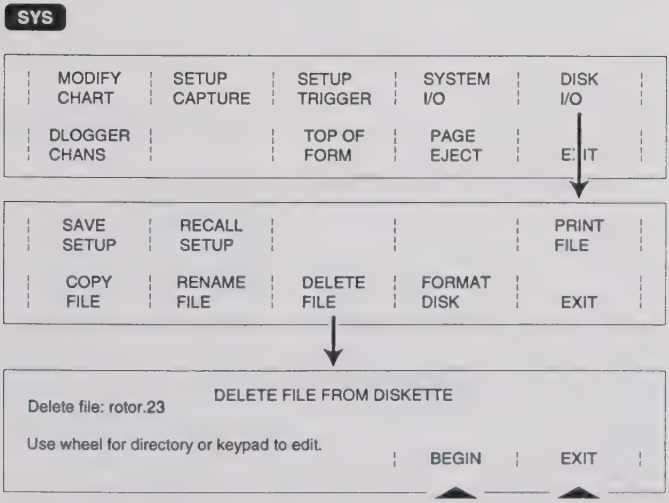
4 **Press the soft key below "DELETE FILE."**

5 **Use the encoder wheel to select from the diskette the name of the file that you want to delete.**

6 **Press the soft key beneath "BEGIN."**

- **The selected file is immediately deleted from the diskette.**

7 **Press the soft key below "EXIT" to leave the "DELETE FILE" menu.**



Formatting diskettes

The DASH 10's front-panel disk drive requires the use of 3.5-inch diskettes. The recorder can format diskettes to either of two format densities:

- 720KB double-sided, double-density (DSDD).
- 1.44MB double-sided, high-density (DSHD).

Use the procedure below to format 3.5-inch diskettes.

1 **Put a 3.5 inch diskette into the front-panel disk-drive.**

2 **Press the front-panel [SYS] key.**

3 **Press the soft key above "DISK I/O."**

4 **Press the soft key below "FORMAT DISK."**

5 **Press the soft key below "DENSITY."**

- **If you are formatting a double-sided, double-density diskette, select the 720KB (DSDD) setting.**
- **If you are formatting a high density diskette, select the 1.44 MB (DSHD) setting.**

6 **Press the soft key below "BEGIN."**

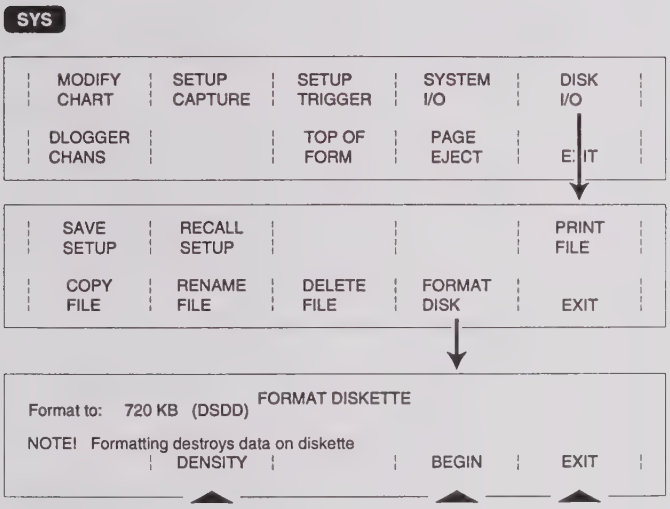
- **The formatting process will begin and the display dynamically shows the number of tracks formatted.**

7 **Press the soft key below "EXIT" to leave the "FORMAT DISK" menu.**

- **See the illustration at the top of the next page.**

10.7

Formatting diskettes



10.8

Printing ASCII files from diskette

The DASH 10 can print ASCII files from diskette. Use the procedure below to print ASCII files from 3.5-inch diskettes.

1. **Put the 3.5 inch diskette containing the ASCII files you want to print into the front-panel disk-drive.**
2. **Press the front-panel [SYS] key.**
3. **Press the soft key above "DISK I/O."**
4. **Press the soft key above "PRINT FILE."**

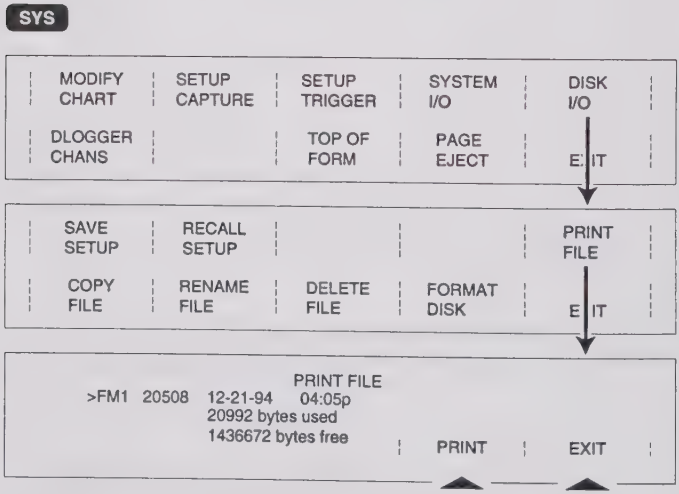
Printing ASCII files from diskette

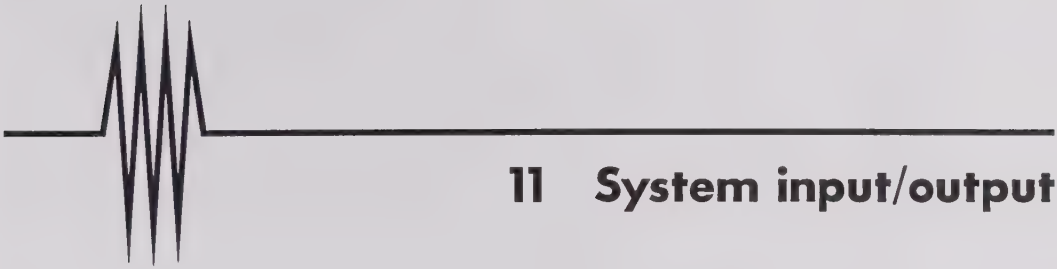
5 Use the encoder wheel to select the name of the ASCII file you want to print.

6 Press the soft key below "PRINT."

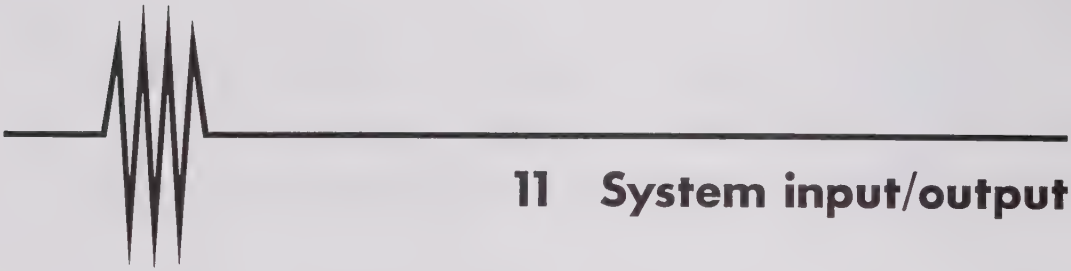
- The selected ASCII file is immediately printed.

7 Press the soft key below "EXIT" to leave the "PRINT FILE" menu.





11 System input/output



11 System input/output

DASH 10 system input/output

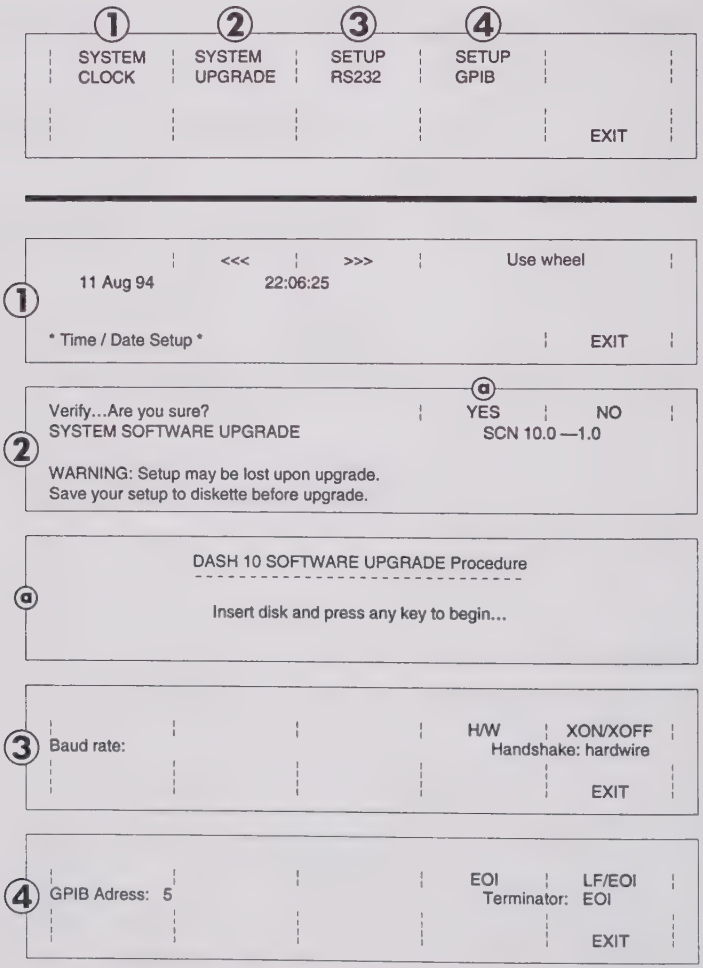
DASH 10 system input / output functions include:

- setting the system clock.
- setting up the RS232 communications interface for host-computer control, if desired.
- setting up the GPIB communications interface for host-computer control, if desired.
- performing system software upgrades.

These functions are defined using the SYSTEM I/O setups of the [SYS] key. The complete menu flow for the SYSTEM I/O setups is shown on page 11-2.

The procedures presented in this section describe how to use each of the DASH 10 system input/output functions.

DASH 10 system input/output



11.2

Setting the system clock

1 Press the front-panel [SYS] key.

2 Press the soft key above "SYSTEM I/O."

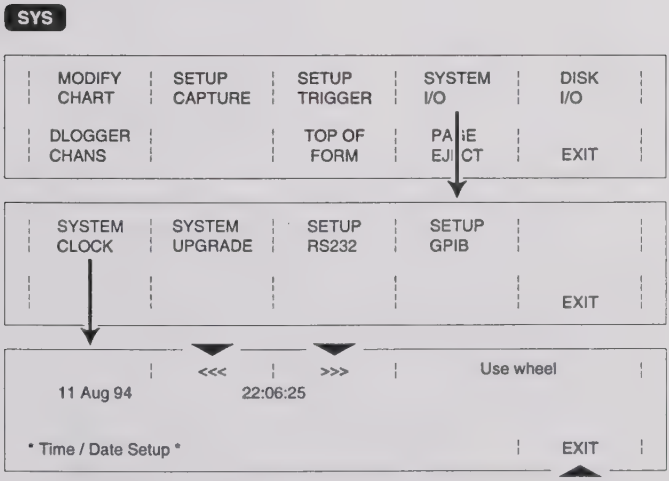
3 Press the soft key above "SYSTEM CLOCK."

4 Press the soft keys above "<<<" or ">>>" and individually select each parameter of the date and time.

- system clock parameters: day, month, year, hour, minute, second.

5 When each parameter is selected, use the encoder wheel to set the parameter to the value you want.

6 Press the soft key below "EXIT" to leave the SYSTEM CLOCK setup menu.



11.3

Setting up the RS232 interface

The complete process of setting up host control over the DASH 10 requires more than setting up the RS232 communications interface. Please refer to the DASH 10 Host Control Manual for additional instructions regarding establishing host control of the recorder.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "SYSTEM I/O."**

3 **Press the soft key above "SETUP RS232."**

4 **Use the encoder wheel to select the baud rate you want to use.**

- **baud rates: 300, 600, 1200, 2400, 4800, 9600, 19200.**
- **baud rate limited to 9600 when XON/XOFF is selected as the handshaking method.**

5 **Press the soft key above "H/W" or "XON/XOFF" and select the communications handshaking method you want to use.**

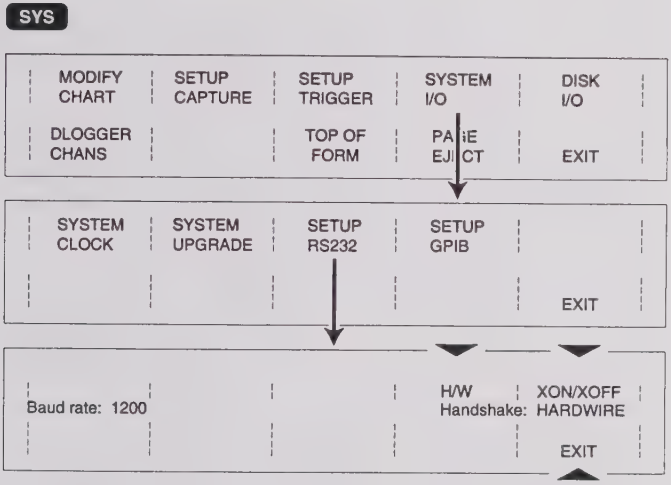
- **handshake methods: hardwire or XON/XOFF.**

6 **Press the soft key below "EXIT" to leave the RS232 setup menu.**

- **See the illustration at the top of the next page.**

11.3

Setting up the RS232 interface



11.4

Setting up the GPIB interface

The complete process of setting up host control over the DASH 10 requires more than setting up the GPIB communications interface. Please refer to the DASH 10 Host Control Manual for additional instructions regarding establishing host control over the recorder.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key above "SYSTEM I/O."**

3 **Press the soft key above "SETUP GPIB."**

4 **Use the encoder wheel to select the GPIB address you want to use.**

- **GPIB addresses: 1 through 31.**

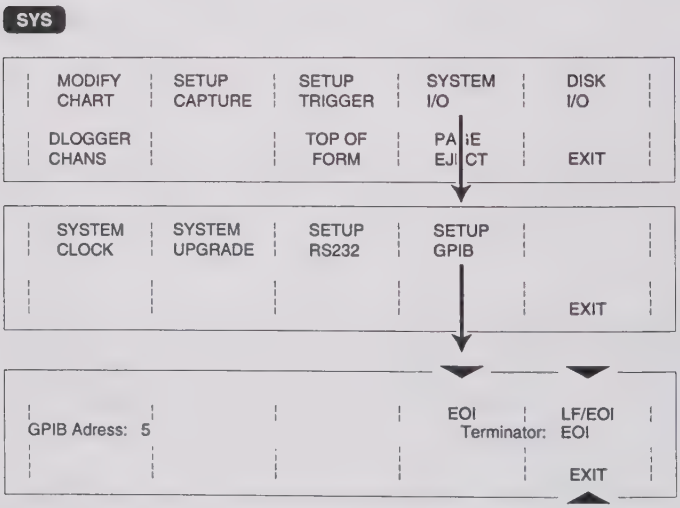
11.4

Setting up the GPIB interface

5 Press the soft key above "EOI" or "LF/EOI" to select the GPIB communications termination method you want to use.

- GPIB terminators: EOI or LF/EOI.

6 Press the soft key below "EXIT" to leave the GPIB setup menu.



11.5

Performing a system software upgrade

1 If you want to save the active recorder setup to diskette, use the procedures described in section 10.3 (Saving a recorder setup to diskette) of this operations manual.

- If you do not save the active recorder setup, it will be lost during the upgrade procedure and will not be recoverable.

Performing a system software upgrade

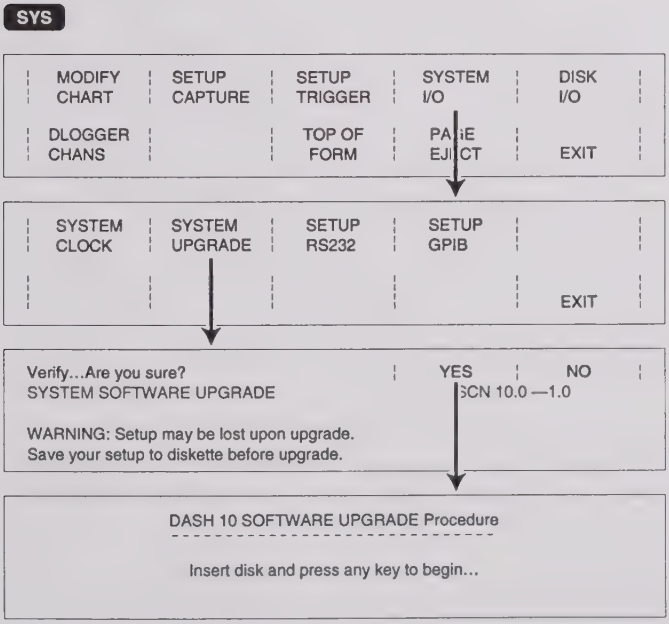
2 **Press the soft key front-panel [SYS] key.**

3 **Press the soft key above "SYSTEM I/O."**

4 **Press the soft key above "SYSTEM UPGRADE."**

- **At this point, a menu prompts you to confirm your intention of performing the software upgrade.**

5 **Press the soft key above "YES" to proceed with the upgrade procedure.**



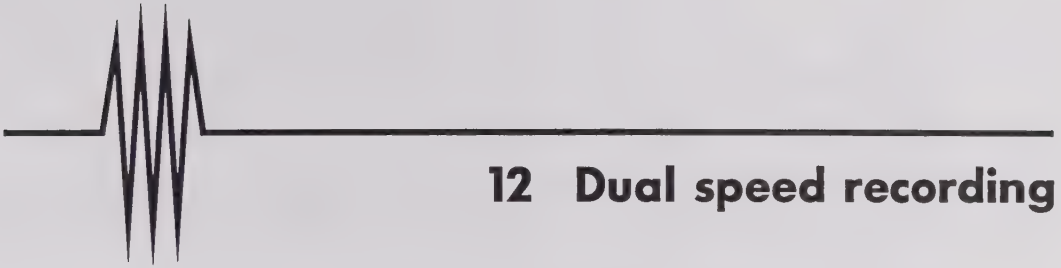
Performing a system software upgrade

6 Insert the diskette containing the software upgrade into the recorder's front-panel disk drive.

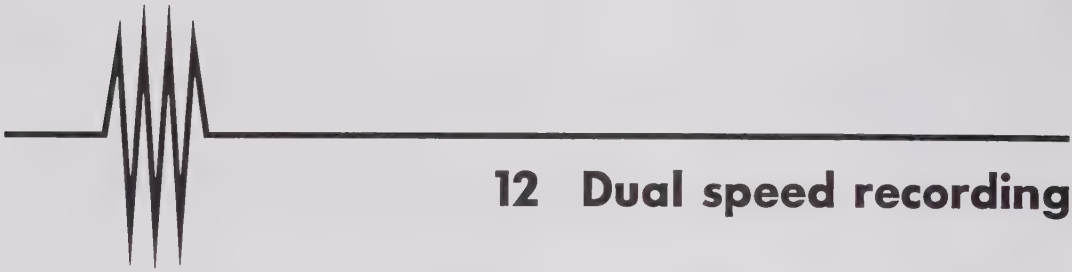
7 Press any front-panel key to start the system software upload.

- An erasure message is followed automatically by a message informing you that the programming phase of the system software upgrade is in progress.
- A final message is generated automatically informing you that the upgrade procedure is complete.

8 Press any front-panel key to begin operating the recorder with the upgraded system software.



12 Dual speed recording



12 Dual speed recording

12.1

Timed and triggered dual speed recording

Dual speed operation allows the DASH 10 to toggle between two recording speeds either as the result of a trigger or the passage of a duration of time.

- Timed dual-speed recording toggles the recorder between two different chart speeds continuously and automatically after operating at each speed for a specified duration of time.

- Triggered dual-speed recording toggles the recorder between two different chart speeds continuously and automatically each time a trigger is sensed.

Time and triggered dual-speed operation are separately discussed below.

12.2

Setting up timed dual-speed recording

Timed dual-speed operation causes the DASH 10 to toggle automatically and continuously between two recording speeds after specific time durations.

When you setup a timed dual-speed recording session, you must define the following parameters:

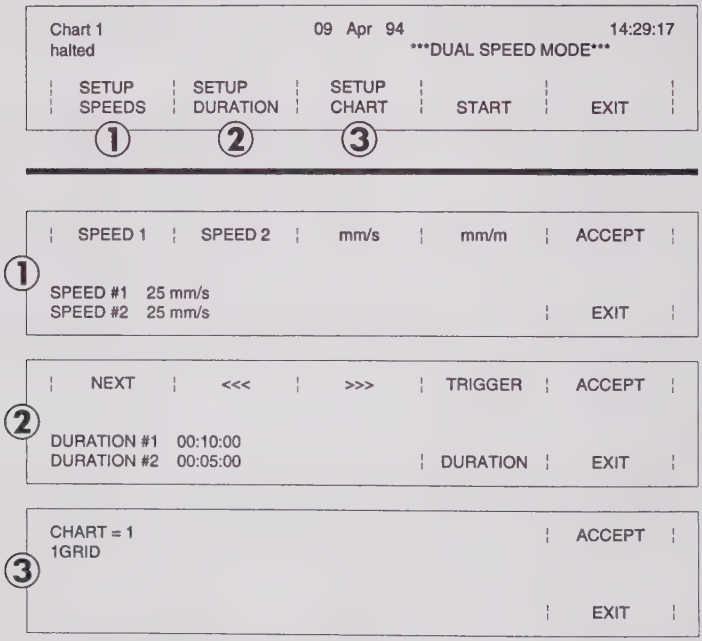
- speed 1
- speed 2
- duration 1
- duration 2
- chart format

The complete menu flow for all DUAL SPEED mode setups is shown in the illustration on the next page.

Use the procedure on the pages that follow to prepare the recorder for timed dual-speed operation.

12.2

Setting up timed dual-speed recording

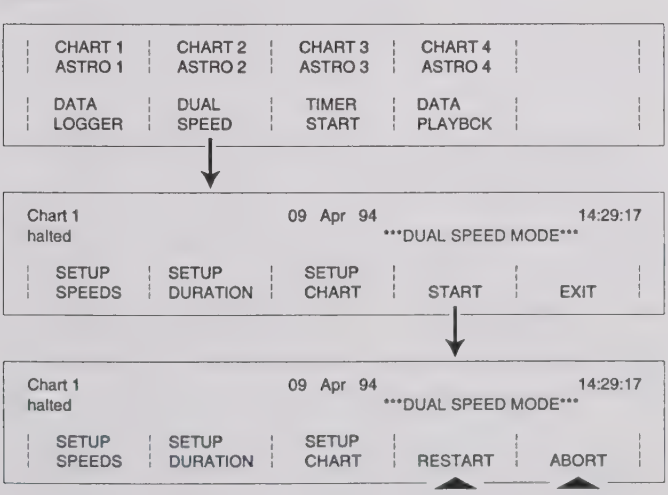


Setting up timed dual-speed recording

1 Press the front-panel [MODE] key.

2 Press the soft key below "DUAL SPEED."

- If the last dual-speed session was a timed session (not a triggered session), then you have the option of using the setup parameters as defined in that last session.
- Press the soft key "START" to begin timed dual-speed recording immediately using the setups of the last timed dual-speed recording session.
- If you halt dual-speed operation, press the soft key below "RESTART" to resume dual-speed recording.
- If you want to abandon operation in the DUAL SPEED mode, press the soft key below "ABORT."



Setting up timed dual-speed recording

3 To define new values for a timed dual-speed mode, press the soft key below "SETUP SPEEDS."

4 Press the soft key above "SPEED1" to select speed 1.

5 Use the encoder wheel to select the chart speed for speed 1.

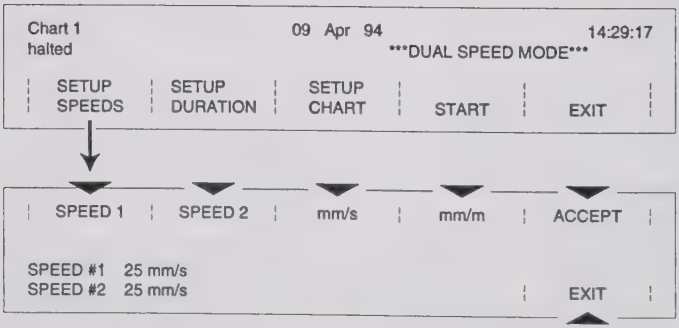
6 Press the soft key above "mm/s" or "mm/m" and select the speed range for the speed 1 parameter.

7 Press the soft key above "SPEED2" to select speed 2.

8 Use the encoder wheel to select the chart speed for speed 2.

9 Press the soft key above "mm/s" or "mm/m" and select the speed range for the speed 2 parameter.

10 Press the soft key above "ACCEPT."



Setting up timed dual-speed recording

11 Press the soft key below "SETUP DURATION."

12 Press the soft key above "NEXT" until the duration #1 parameter is selected.

- The parameter blinks when selected.

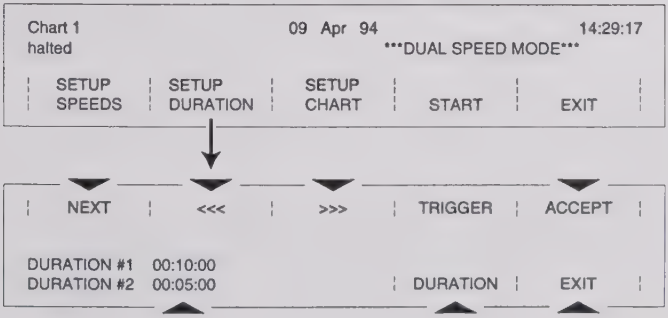
13 Press the soft key above "<<<" or ">>>" and select hours, minutes, and seconds settings for the duration #1 parameter.

14 When each of the time parameters is selected, use the encoder wheel to set the duration in hours, minutes, and seconds.

15 Press the soft key above "NEXT" until the duration #2 parameter is selected.

16 Repeat steps 12 through 14 for duration #2.

17 Press the soft key above "ACCEPT."

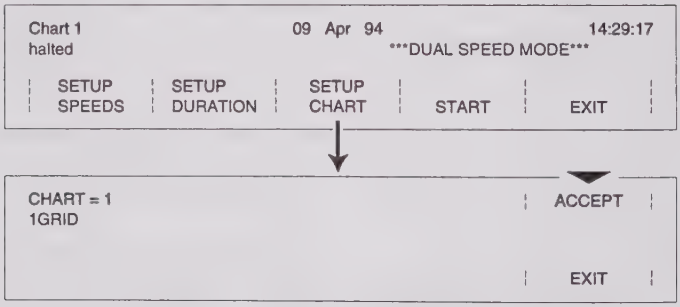


Setting up timed dual-speed recording

18 **Press the soft key below "SETUP CHART."**

19 **Use the encoder wheel to select the chart format that you want to use.**

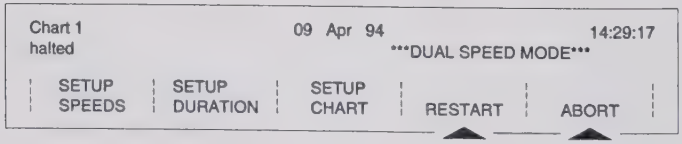
20 **Press the soft key above "ACCEPT."**



21 **Press the soft key below "START" to enter the timed dual-speed recording mode you just setup.**

22 **If you use the [RUN/HALT] key to halt timed dual-speed recording, press the soft key below "RESTART" to resume recording.**

23 **Press the soft key below "ABORT" if you want to cancel timed dual-speed recording and exit the mode.**



Setting up triggered dual-speed recording

Triggered dual-speed operation causes the DASH 10 to toggle automatically and continuously between two recording speeds each time the DASH 10 detects a trigger from any of the four valid trigger sources.

A trigger must be defined using the "SETUP TRIGGER" parameter found under the [SYS] key setups before the DASH 10 is used in the triggered dual-speed recording mode. See section 7, Setting up and enabling triggers.

When you setup a triggered dual-speed recording session, you must define the following parameters:

- speed 1
- speed 2
- duration 1 to trigger
- duration 2 to trigger
- chart format

Use the procedure below to prepare the recorder for triggered dual-speed operation.

1 **Press the front-panel [MODE] key.**

2 **Press the soft key below "DUAL SPEED."**

- **If the last dual-speed session was a triggered session (not a timed session), then you have the option of using the setup parameters as defined in that last session.**
- **Press the soft key below "START" to begin triggered dual-speed recording immediately using the setups of the last triggered dual-speed recording session.**
- **See the illustration on page 12-3.**

3 **To define new values for a triggered dual-speed mode, press the soft key below "SETUP SPEEDS."**

Setting up triggered dual-speed recording

4 Press the soft key above "SPEED1."

- The parameter blinks when selected.

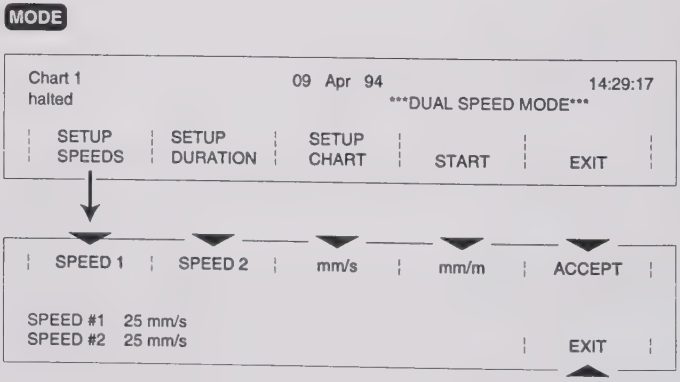
5 Press the soft key above "mm/s" or "mm/m" and select the speed range for the speed #1 parameter.

6 Use the encoder wheel to select the chart speed for speed #1.

7 Press the soft key above "SPEED2."

8 Repeat steps 5 and 6 for speed #2.

9 Press the soft key above "ACCEPT."



Setting up triggered dual-speed recording

10 Press the soft key below "SETUP DURATION."

11 Press the soft key above "NEXT" until the duration #1 parameter is selected.

- The parameter blinks when selected.

12 Press the soft key above "TRIGGER."

Note that the duration parameter in the menu dynamically changes to "Trigger."

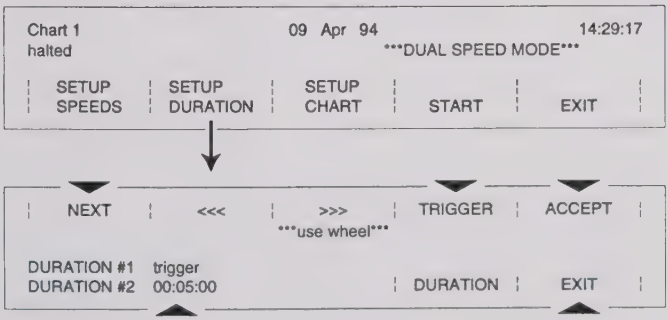
13 Press the soft key above "NEXT" until the duration #2 parameter is selected.

The parameter blinks when selected.

14 Press the soft key above "TRIGGER."

Note that the duration parameter in the menu dynamically changes to "Trigger."

15 Press the soft key above "ACCEPT."

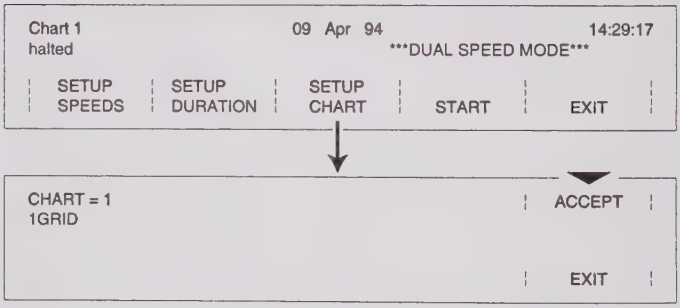


Setting up triggered dual-speed recording

16 **Press the soft key below "SETUP CHART."**

17 **Use the encoder wheel to select the chart format that you want to use.**

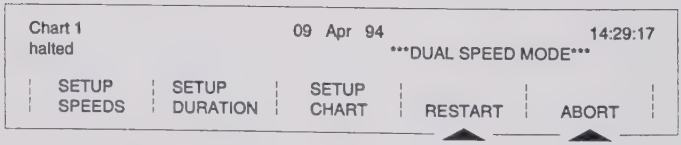
- **The "Chart =" parameter changes dynamically.**

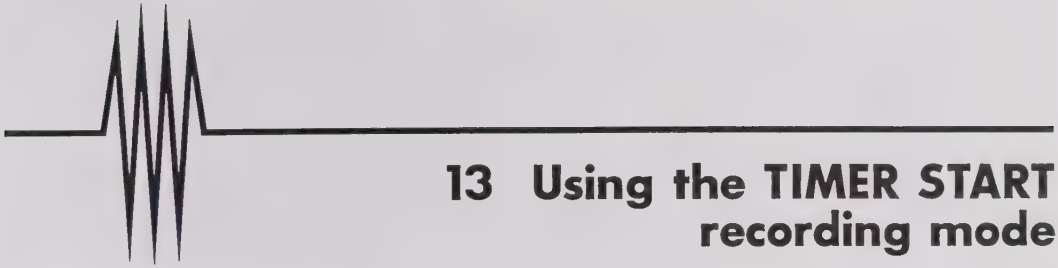


18 **Press the soft key below "START" to enter the triggered dual-speed recording mode you just setup.**

19 **If you use the [RUN/HALT] key to pause triggered dual-speed recording, press the soft key below "RESTART" to resume recording.**

20 **Press the soft key below "ABORT" if you want to cancel triggered dual-speed recording and exit the mode.**





13 Using the TIMER START recording mode

13 Using the TIMER START recording mode

Setting up the TIMER START recording mode

The TIMER START setup is used to program the DASH 10 to start recording at a specific time and date and to end recording at a specific time and date. When you setup a timed recording session, you must define the following parameters:

- start time: day, month, year, hour, minute, second.
- stop time: day, month, year, hour, minute, second.
- chart format.

Use the procedure below to setup a timed-recording session.

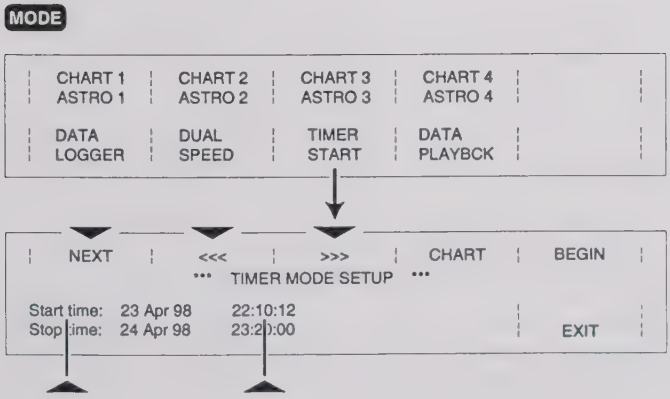
1 **Press the front-panel [MODE] key.**

2 **Press the soft key below "TIMER START."**

3 **Press the soft key above "NEXT" until the "Start Time" field is selected.**

4 **Press the soft key above "<<<" and ">>>" to individually select the day, month, year, hour, minute, and seconds parameters.**

- **When each element is selected, use the encoder wheel to specify the settings that you want.**

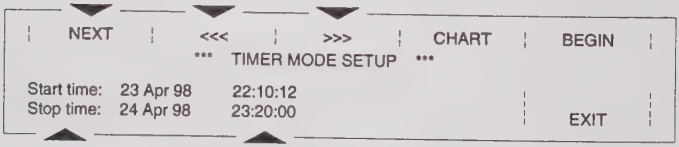


Setting up the TIMER START recording mode

5 To set the "Stop time" field for a timed recording session, press the soft key above "**NEXT**" until the stop time parameter is selected.

6 Press the soft key above "**<<<**" and "**>>>**" to individually select the day, month, year, hour, minute, and seconds parameters.

- When each element is selected, use the encoder wheel to specify the settings that you want.

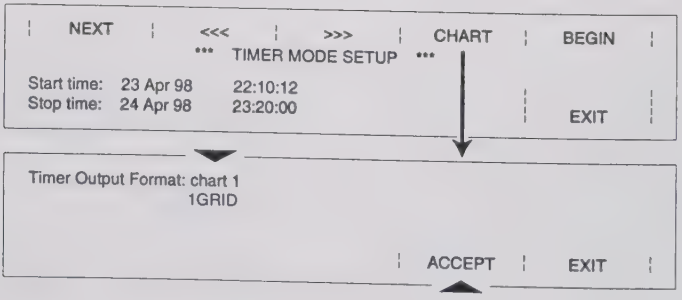


7 Press the soft key above "**CHART.**"

8 Use the encoder wheel to select the chart format that you want used during the timed recording.

- The "Chart=" field in the menu changes dynamically.

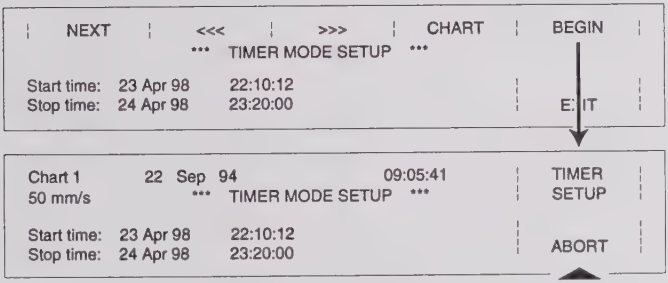
9 Press the soft key below "**ACCEPT.**"



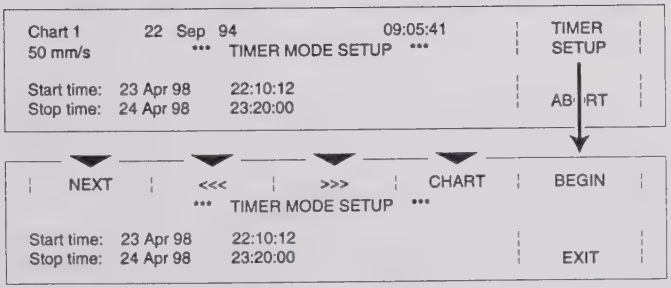
Setting up the TIMER START recording mode

10 Press the soft key above "BEGIN" to start the TIMER MODE.

11 Press the soft key below "ABORT" if you want to cancel the timed recording session and exit the timed mode.



12 Press the soft key above "TIMER SETUP" to return to the TIMER MODE setup menu to change any of the timed recording setups.



Starting immediate recording in the TIMER START mode

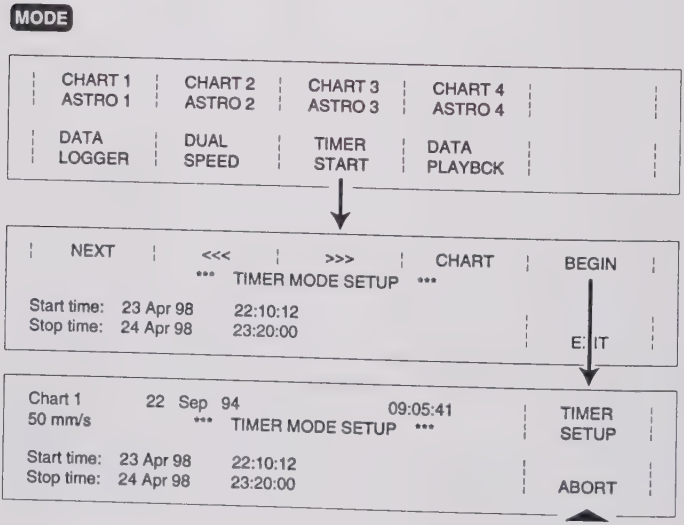
Use the procedure below to enter the recorder into timed operation using the same settings as the immediately previous timed-recording session.

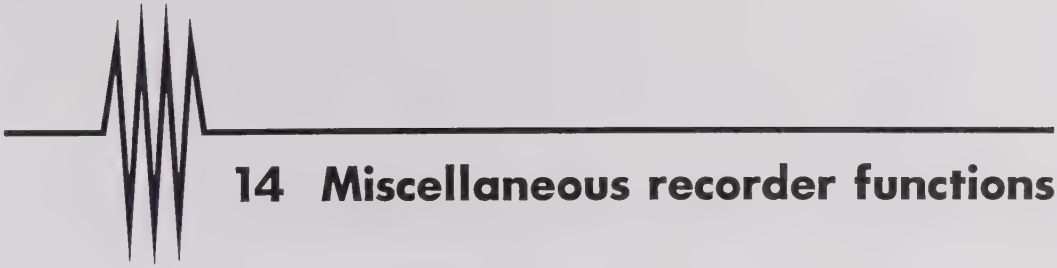
1 **Press the front-panel [MODE] key.**

2 **Press the soft key below "TIMER START."**

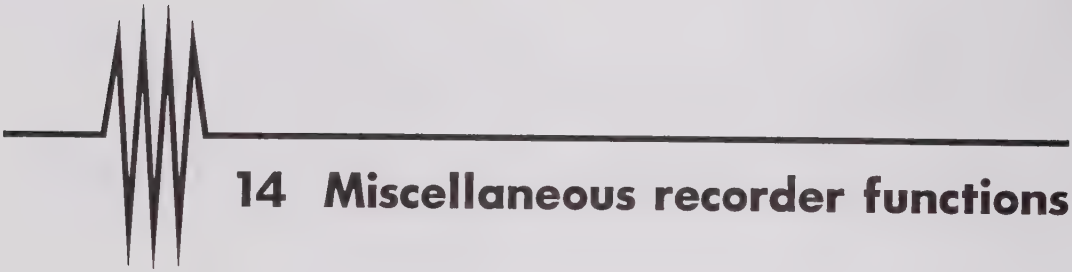
3 **Press the soft key above "BEGIN" to use the setup parameters of the last timed recording session and begin timed operation immediately.**

4 **Press the soft key below "ABORT" if you want to cancel the timed recording session and exit the timed mode.**





14 Miscellaneous recorder functions



14 Miscellaneous recorder functions

14-1

Miscellaneous recorder functions

This section discusses the use of the following miscellaneous DASH 10 front-panel keys:

- [HELP] key
- [EVNT] key
- [RUN/HALT] key
- [FEED] key

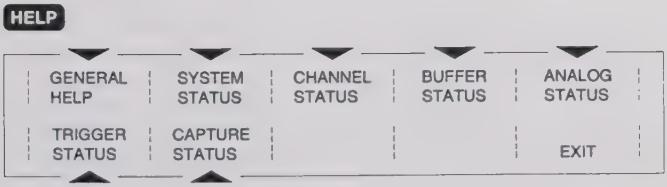
The recorder's top-of-form and page eject functions are also discussed in this section.

14-2

Using the [HELP] key

When the front-panel [HELP] key is pressed, the menu that results provides the following selections:

- GENERAL HELP
- SYSTEM STATUS
- CHANNEL STATUS
- BUFFER STATUS
- ANALOG STATUS
- TRIGGER STATUS
- CAPTURE STATUS



Using the [HELP] key

- When the soft key above "GENERAL HELP" is pressed, the DASH 10 automatically prints a report called "An Overview of the Astro-Med DASH 10 Recorder." An example of a GENERAL HELP printout is given on the next page. The overview provides concise discussions of the following aspects of operating the recorder and understanding its features:

  - quick method of operating the recorder.
  - using soft keys.
  - using the encoder wheel.
  - controlling chart speed.
  - understanding the real-time menu.
  - using the [FREEZE DISPLAY] soft key.
  - using the [DISPLAY TEXT] soft key.
  - using the trilevel timing marks.
  - using grids.
  - using the built-in waveform monitor.
  - using the floppy disk drive.
  - selecting a chart format.
  - using annotation.

- When the soft key above "SYSTEM STATUS" is pressed, the DASH 10 automatically prints a report called "DASH 10 SYSTEM STATUS." An example of a DASH 10 SYSTEM STATUS printout is given on page 14-4. The system status report summarizes:

  - host settings.
  - realtime recorder settings.
  - datalogger settings.
  - timer mode settings.
  - dual-speed settings.

- When the soft key above "CHANNEL STATUS" is pressed, the DASH 10 automatically prints a report called "DASH 10 CHANNEL STATUS." An example of a DASH 10 CHANNEL STATUS printout is given on page 14-5. The channel status report summarizes:

  - pen, grid, and event status.
  - event location.
  - grid size and location.
  - number of major and minor grid divisions.

Using the [HELP] key

An Overview of the Astro-Med DASH 10 Recorder

This recorder offers a wide range of recording capabilities with easy to use front panel control. The bright vacuum fluorescent displays provide clear menus which quickly guide the user through system operation with little or no prior training.

TO OPERATE THE RECORDER QUICKLY: Simply turn on the recorder and push the [RUN/HALT] key. This will cause the system to record realtime waveforms using a traditional recorder grid format.

SOFT KEYS: There are ten keys mounted directly around the displays. The function of these soft keys changes with the menu. When they are active a label will appear just below the key indicating its function.

ENCODER WHEEL: Some menus make use of the wheel (a large knob on the front panel) to change settings quickly.

CHART SPEED: A group of keys in the lower center of the panel controls chart speed. Dedicated keys provide a means for quickly setting common chart speeds. Non-standard speeds chan be set easily by pressing the [SPD] key and entering the desired speed using the knob. The three insta-speed keys [A], [B], and [C] can be programmed for any available speed using the same [SPD] menu.

REALTIME MENU: When the DASH 10 has been instructed to record realtime waveforms and/or events, it displays the Realtime Menu. The top line indicates the chart number, the time and date, the speed and the state of the recorder (usually RUNNING or HALTED).

The [FREEZE DISPLAY] soft key will halt the waveform monitor without affecting the chart. When the display is frozen the key label changes to [RUN DISPLAY]. If pressed, the monitor begins operating again.

The [DISPLAY TEXT] softkey will clear the bottom two lines of text and allow the waveform data to use that remaining display area.

TIMER: The DASH 10 can record a tri-level time mark. The shortest mark is synchronized to an internal time reference. The medium mark occurs once for every ten short marks and the long mark occurs once for every 100 short marks. The short marks can be programmed to occur over a variety of rates from 0.1 seconds to 60 seconds. Tri-level mark s can be located on the left side of the chart, the right side of the chart, or on both sides.

GRIDS: Each waveform being recorded is associated with a grid. Grids can be custom made by choosing major or minor divisions. Grid divisions in the time axis are spaced on even millimeter boundaries. The user can elect to synchronize

GENERAL HELP status report

Using the [HELP] key

DASH 10 SYSTEM STATUS

HOST SETTINGS

Baud Rate	300
Handshake Method	HARDWIRE
GPIB Address	1
GPIB Terminator	EOI

REALTIME RECORDER SETTINGS

Active Chart	1 - 1GRID
Speed	200 mm/s
Insta-Speed A	10 mm/s
Insta-Speed A	75 mm/s
Insta-Speed A	150 mm/s
Motor Source	internal
VF Display Status	RUN
Auto ID	on
Trace Thickness	1
Grid Type	standard
Time Marks	0.02 secs - both sides

DATA LOGGER SETTINGS

Data Logger Speed	200 ms/l
Data Logger Channels	1 2 3 4 5 6 7 8

TIMER MODE SETTINGS

Start Time	01 Jan 96	00:00:00
Stop Time	02 Jan 96	00:00:00
Timer Chart	1 - 1GRID	

DUAL SPEED SETTINGS

Speed 1	200 mm/s
Speed 1 Duration	00:00:03
Speed 2	100 mm/m
Speed 2 Duration	00:00:03

Astro-Med, Inc.

SYSTEM STATUS report

Using the [HELP] key

DASH 10 CHANNEL STATUS

Channel	Pen Status	Grid Status	Grid Size	Number Majors	Number Majors	Location
1	down	on	200 mm	40	5	26 mm
2	down	off	200 mm	40	5	26 mm
3	down	off	200 mm	40	5	26 mm
4	down	off	200 mm	40	5	26 mm
5	down	off	200 mm	40	5	26 mm
6	down	off	200 mm	40	5	26 mm
7	down	off	200 mm	40	5	26 mm
8	down	off	200 mm	40	5	26 mm
9	down	off	200 mm	40	5	26 mm
10	down	off	200 mm	40	5	26 mm

Event System	Event Status	Location	Global Event Type: standard
1	on	fixed	
2	off	0.00 mm	
3	off	0.00 mm	
4	off	0.00 mm	
5	off	0.00 mm	
6	off	0.00 mm	
7	off	0.00 mm	
8	off	0.00 mm	
9	off	0.00 mm	
10		0.00 mm	

Astro-Med, Inc.

CHANNEL STATUS report

Using the [HELP] key

- When the soft key above "BUFFER STATUS" is pressed, the DASH 10 automatically prints a report called "DASH 10 TEXT BUFFERS." An example of a DASH 10 TEXT BUFFERS printout is given on page 14-7. The text buffers report summarizes:

  - buffer contents.
  - buffer status.
  - chart location.

- When the soft key above "ANALOG STATUS" is pressed, the DASH 10 automatically prints a report called "DASH 10 ANALOG STATUS." An example of a DASH 10 ANALOG STATUS printout is given on page 14-8. The analog status report summarizes:

  - full scale range values.
  - zero position.
  - zero suppression values.
  - DC/GND status.
  - mode.
  - filter status.

- When the soft key above "TRIGGER STATUS" is pressed, the DASH 10 automatically prints a report called "DASH 10 TRIGGER STATUS." An example of a DASH 10 TRIGGER STATUS printout is given on page 14-9. The trigger status report summarizes:

  - periodic trigger settings.
  - AND / OR trigger settings.
  - trigger window data.

- When the soft key above "CAPTURE STATUS" is pressed, the DASH 10 automatically prints a report called "DASH 10 CAPTURE STATUS." An example of a DASH 10 CAPTURE STATUS printout is given on page 14-10. The capture status report summarizes:

  - playback settings.
  - capture settings.
  - board settings.

Using the [HELP] key

Astro-Med, Inc.

DASH 10 TEXT BUFFERS

SYSTEM BUFFER	STATUS:	on	
DEMAND BUFFER			LOCATION: 65.28 mm
BUFFER #1 Channel #1	STATUS:	on	LOCATION: 242.10 mm
BUFFER #2 Channel #2	STATUS:	on	LOCATION: 239.38 mm
BUFFER #3 Channel #3	STATUS:	on	LOCATION: 236.66 mm
BUFFER #4 Channel #4	STATUS:	on	LOCATION: 233.94 mm
BUFFER #5 Channel #5	STATUS:	on	LOCATION: 46.24 mm
BUFFER #6 Channel #6	STATUS:	on	LOCATION: 16.32 mm

BUFFER STATUS report

Using the [HELP] key

Astro-Med, Inc.

DASH 10 ANALOG STATUS

Channel	Full Scale Range	Zero Position	Zero Suppression	DC/GND	Mode	Filter
1	10.00 V	0.00%	0.00 V	dc	pk–pk	off
2	10.00 V	0.00%	0.00 V	dc	pk–pk	off
3	10.00 V	0.00%	0.00 V	dc	pk–pk	off
4	10.00 V	0.00%	0.00 V	dc	pk–pk	off
5	10.00 V	0.00%	0.00 V	dc	pk–pk	off
6	10.00 V	0.00%	0.00 V	dc	pk–pk	off
7	10.00 V	0.00%	0.00 V	dc	pk–pk	off
8	10.00 V	0.00%	0.00 V	dc	pk–pk	off
9	10.00 V	0.00%	0.00 V	dc	pk–pk	off
10	10.00 V	0.00%	0.00 V	dc	pk–pk	off

ANALOG STATUS report

Using the [HELP] key

DASH 10 TRIGGER STATUS

MAIN OR: Manual Periodic
PERIODIC RATE: 00:00:10

ANALOG TRIGGER SETTINGS
BOARD 1 OR COMBINATION: 1 2 3 4 5 6 7 8 9 10
BOARD 1 AND COMBINATION: 1 2 3 4 5 6 7 8 9 10

Channel	Low Level	High Level	Window
1	0%	100%	inside
2	0%	100%	inside
3	0%	100%	inside
4	0%	100%	inside
5	0%	100%	inside
6	0%	100%	inside
7	0%	100%	inside
8	0%	100%	inside
9	0%	100%	inside

Astro-Med, Inc.

TRIGGER STATUS report

Using the [HELP] key

DASH 10 CAPTURE STATUS

PLAYBACK SETTINGS

Window Start	1 samples
Window End	65536 samples
Expansion	1
Playback Format	xy - plot
Playback Destination	display & chart
Report	off
X Channel	1
Y Channel	7

CAPTURE SETTINGS

Auto-Trigger	off
Capture Control	multi-capture (stacking)
Capture Link	off

BOARD 1 SETTINGS

Sample Rate	250 kHz
Trigger Position	50%
Capture Size	11 x 69k
Channels Enabled	evts 1 2 3 4 5 6 7 8 9 10
Board Status	on

Astro-Med, Inc.

CAPTURE STATUS report

14-3

Using the [EVNT] key

The front-panel [EVNT] provides a manual method for toggling the DASH 10's system event marker on and off during realtime recording. The system event marker must be turned on as described in section 4.2.3 of this manual.

Press the front-panel [EVNT] key when you want to cause the system event marker to deflect to mark data of interest.

14-4

Using the [RUN/HALT] key and the [FEED] key

When pressed, the front-panel [RUN/HALT] key alternately stops printing of realtime data or resumes printing of realtime data.

Press the front-panel [RUN/HALT] key when you want a manual method to stop or resume printing realtime data.

When pressed, the front-panel [FEED] key advances chart paper through the paper path and out of the recorder. When the [FEED] key is released, the paper stops.

Press the front-panel [FEED] key when you need a manual method to advance the chart paper through the paper path.

14-5

Using the TOP-OF-FORM capability

A top-of-form index mark is printed on the rear (nonprinting) side of each sheet of the Astro-Med roll thermal paper used by the DASH 10. The top-of-form mark is used:

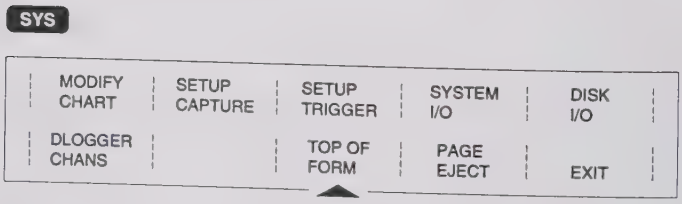
- to advance a page so that printing begins at the top of the page's print area.
- to position the perforation between pages for easy removal of printed pages.

Use the procedure below to advance the roll thermal paper to the next top-of-form index mark.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key below "TOP OF FORM."**

- **The chart paper is immediately advanced to the next top of form index mark.**
- **If the chart paper is already at a top-of-form mark, the paper will not advance.**



14-6

Using the PAGE EJECT function

Like the top-of-form capability, the page eject function advances the chart paper to the next top of form index mark. The page eject capability can be used as an alternative to the top-of-form capability.

14-6

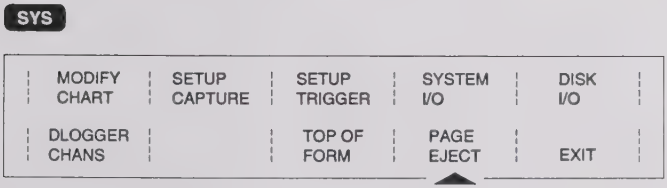
Using the PAGE EJECT function

Use the procedure below to use the page eject function to advance the roll thermal paper to the next top-of-form index mark.

1 **Press the front-panel [SYS] key.**

2 **Press the soft key below "PAGE EJECT."**

- **The chart paper is immediately advanced to the next top of form index mark.**
- **Whether or not the chart paper is at a top-of-form mark, the paper is always advanced to the next top-of-form mark.**



14-7

DASH 10 error messages

Error messages may be automatically generated and shown on the front-panel display if the recorder detects problems in any of the following areas:

- hardware power-on.
- general system initialization.
- calibration.
- analog board activities.
- communications.

The error messages that may be encountered are summarized on the pages that follow. If the system experiences any error identified as "FATAL," contact Astro-Med technical support at (401) 828-4000 for guidance. Fatal errors generally indicate serious problems that may require return of the recorder for repair.

DASH 10 error messages

HARDWARE POWER ON ERRORS

- **Fatal Error: - 8254 timer error**

  System could not initialize timer chip. System will not continue.

- **Fatal Error: - Real Time Clock error**

  System could not initialize system clock. System will not continue.

- **Warning: - GPIB error**

  System could not initialize GPIB controller chip. System will continue.

- **Warning: - Floppy Disk Drive error**

  System failed to recognize floppy disk drive. Controller chip or disk drive is no responding.

  System will continue.

- **Warning: - A/D board communication error**

  System failed initialization test with A/D board. Dual port, AD-DSP, or AD-board failure. System will continue.

DASH 10 error messages

GENERAL SYSTEM ERRORS

- **PAPER OUT OR DOOR OPEN**

  Interlock sensor active. Either the paper has run out or the door is open.

- **Warning: LOW battery-NV data will be lost.**

  System detected low battery. This tells user that the system setup will be lost unless it is saved to disk or host.

FLOPPY DISK DRIVE ERRORS

- **Status: ERROR - Disk error - general**

  General disk read or write error. Usually indicates bad sector on diskette.

- **Status: *** No files present ***
- **Status: ERROR - Invalid filename**
- **Status: ERROR - Insufficient disk space**
- **Status: ERROR - No disk drive present**
- **Status: ERROR - Write protect on**
- **Status: ERROR - File not found**
- **Status: ERROR - No disk in drive**
- **Status: ERROR - Maximum allowed files**
- **Status: ERROR - Duplicate file name**
- **Status: ERROR - Invalid file size**

DASH 10 error messages

CALIBRATION ERRORS

- **command error**

  A/D board failed to respond

- **ZS out of range**

  offset was so large that compensation could not be adjusted.
  Zero Suppression can not be changed.

- **Time out on ZS**

  AD-DSP failed to respond to Zero Suppression command.

- **ZP out of range**

  offset was so large that compensation could not be adjusted.
  Zero Position can not be changed.

- **Time out on ZP**

  AD-DSP failed to respond to Zero Position command.

- **Time out on gain**

  Gain could not be changed.
  reference voltage not valid.

DASH 10 error messages

ANALOG BOARD ERRORS

- **ERROR: AD dual port time-out**

  timed out waiting for dual port handshaking.

- **ERROR: AD status failure ????, ??, ??, ??**

  General status failure during AD-DSP to AD board operation.
  Codes - for internal use only.
  General status, slot #2 status, slot #3 status, slot #4 status
  If slot status is not zero, the board in that slot failed.

- **ERROR: AD command failure ????, ??, ??, ??**

  AD-DSP failed to complete the command. Slot status should tell which board failed.

- **ERROR: No AD connection present**

  No AD boards available in the system.

- **ERROR: Unable to program AD DSP**

  AD-DSP software programming failure.

- **ERROR: AD board not found**

  Board not present in system

- **ERROR: Error addressing AD slot**

  Board is there, but unable to address.

- **ERROR: DMA Time-out on RCLK**

  System timed out waiting for data from AD-DSP.

DASH 10 error messages

COMMUNICATION ERRORS

- **Command Error**

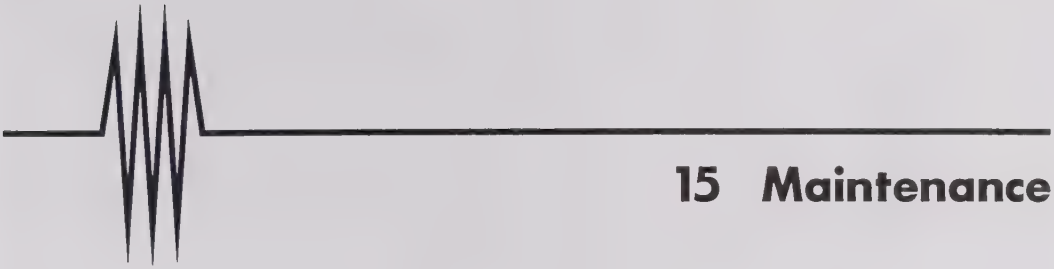
  invalid command or command protocol violated.

- **Execution Error**

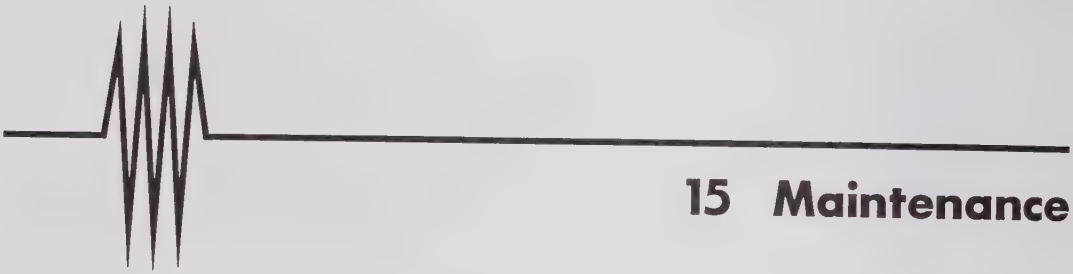
  error during an execution of a command.

- **Overrun Error**

  over ran input buffer - data will be lost.



15 Maintenance



15 Maintenance

15.1

Maintenance procedures

Maintenance of the DASH 10 is discussed in the following order:

- changing the recorder's fuses / operating voltage.
- cleaning the printhead.
- replacing or adjusting the printhead.
- replacing a battery pack.
- calibrating voltage plug-in modules.
- replacement parts.

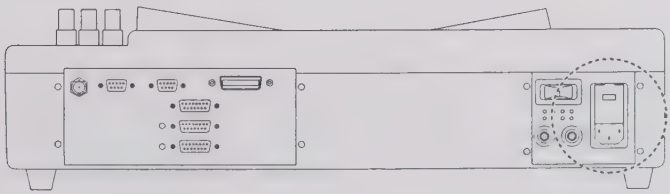
15.2

Changing the fuses / line-voltage setting

The line voltage of your DASH 10 has been factory set to your specifications and should not need adjustment. If you want to change the line voltage at which the recorder will operate, use the procedure below.

1 **Turn off the recorder, unplug it, and remove its power cord.**

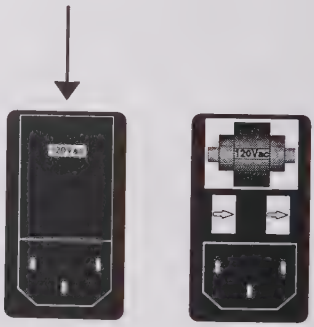
2 **On the recorder's rear panel, locate the power input receptacle / voltage selection box.**



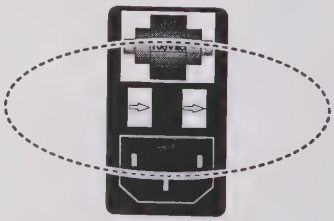
Changing the fuses / line-voltage setting

2 With a small flat-head screwdriver:

- open the fuse block/voltage selection box.
- this exposes the fuses and the voltage selection cylinder.



3 Locate the fuses just below the voltage selection cylinder.



4 To change the recorder's fuses:

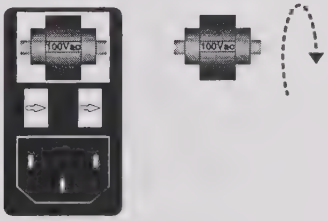
- remove the two fuse-holding fixtures from the block.
- replace both fuses with fuses appropriate to the voltage that will be powering the recorder:
  - two 1A 250V fuses for operation at 220VAC.
  - two 2A 250V fuses for operation at 120VAC.

15.2

Changing the fuses / line-voltage setting

5 **To change the recorder's line-voltage setting:**

- **remove the cylindrical voltage indicator from the voltage selection box.**
- **orient the indicator to match the operating voltage that you are selecting: 100VAC, 120VAC, 220VAC, or 240VAC.**
- **reinsert the voltage indicator.**
- **close the voltage selection box.**



15.3

Cleaning the printhead

For best performance, the print elements of the DASH 10's printhead must be kept free of any debris or residue buildup. Cleaning the printhead refers to cleaning the hairline row of print elements that can be seen running across the bottom of the printhead.

15.3

Cleaning the printhead

Printheads must be cleaned on a regular basis according to the following schedule:

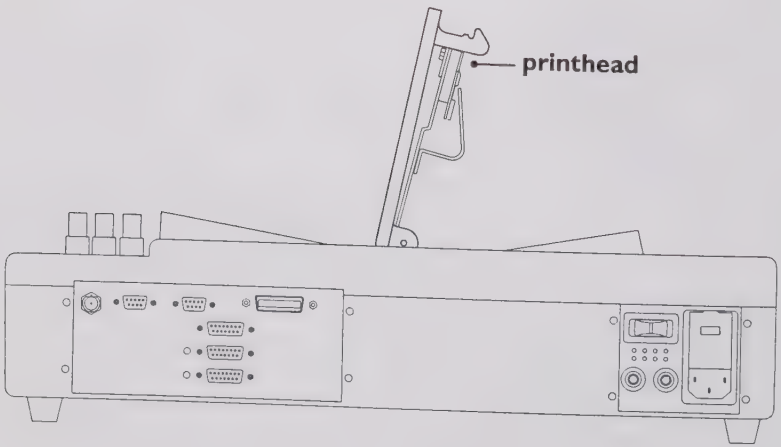
- If your application primarily trends to speeds slower than 5 mm/second, clean the printhead every time you load the recorder with a new roll of chart paper.
- If your application primarily trends to speeds higher than 5 mm/second, clean the printhead every ten rolls of chart paper.

Use the procedure below to clean the DASH 10's printhead.

1 **Turn off the DASH 10.**

2 **Press the paper-chamber door release to open the paper chamber door.**

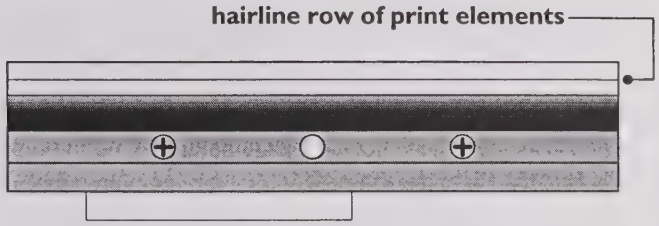
- **Note that the printhead is attached to the printhead plate mounted to the underside of the paper-chamber door.**



15.3

Cleaning the printhead

3 **Locate the hairline row of print elements on the printhead.**



4 **Wet a clean, lint-free cloth or cotton swab with isopropyl alcohol.**

5 **Run the cloth or swab beneath the printhead repeatedly as necessary to remove any residue that may be present.**

- **This complete's the printhead cleaning process.**

15.4

Replacing or adjusting the printhead

The DASH 10's printhead is attached to the printhead plate on the underside of the paper chamber door. The printhead is extremely reliable and would only require adjustment or replacement in rare instances.

Use the procedure below to replace or adjust the DASH 10's printhead.

1 **Turn off and unplug the DASH 10.**

2 **Press the paper-chamber door release to open the paper chamber door.**

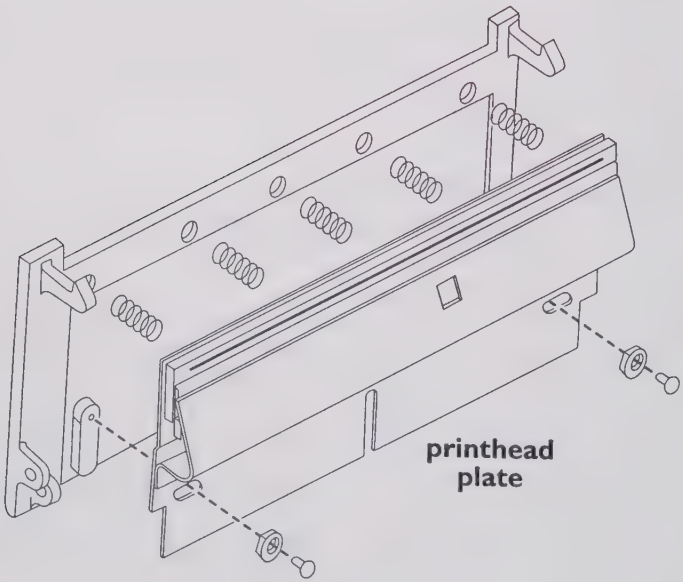
3 **Locate the printhead plate and the printhead on the underside of the paper-chamber door.**

Replacing or adjusting the printhead

3 Locate the printhead plate and the printhead on the underside of the paper-chamber door (see page 17-40.

4 Remove the two Phillips-head screws and the eccentric nuts that secure the printhead plate with the attached printhead to the door.

- When the printhead plate is taken off, five printhead pressure springs are freed.
- Ensure that the screws, nuts, and springs are retained and set aside for later reuse in the reassembly process.
- To simplify the reassembly, keep the removed hardware within easy reach.

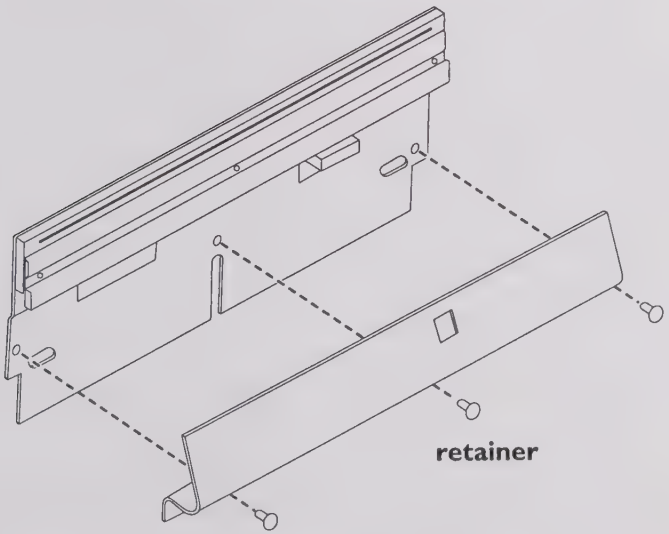


Replacing or adjusting the printhead

5 Completely detach the printhead plate by unplugging the ribbon cable that attaches to the printhead.

6 Remove the three Phillips-head screws and the associated washers that attach the printhead retainer to the printhead plate.

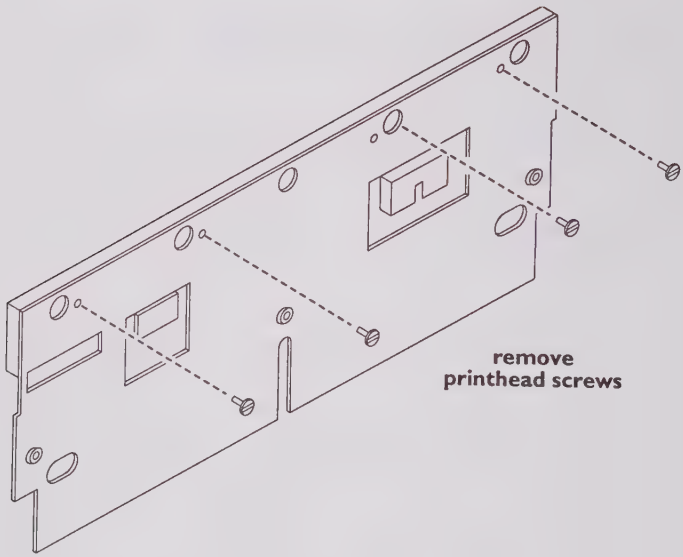
- Set the printhead retainer and its screws aside.



7 On the rear of the printhead plate, remove the four slot-headed screws and the associated washers that secure the printhead to the plate.

- See the illustration at the top of the next page.

Replacing or adjusting the printhead



8 Set the removed printhead aside.

9 Attach the replacement printhead to the printhead plate using the screws and washers removed in step 7.

10 Reattach the printhead retainer using the screws and washers removed in step 6.

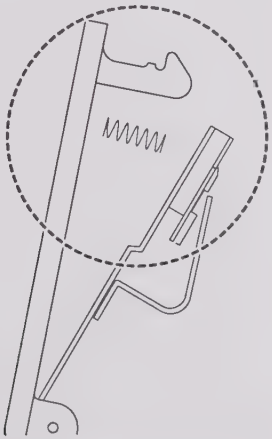
11 Reattach the printhead ribbon cable to its receptacle on the printhead.

12 Position the printhead plate on the underside of the paper-chamber door.

Replacing or adjusting the printhead

13 Insert each of the five printhead springs between the rear of the printhead and the paper-chamber door.

- Recesses are provided for the springs on the rear of the printhead plate and the underside of the paper chamber door.
- A pair of needle-nosed pliers helps to simplify inserting the springs.



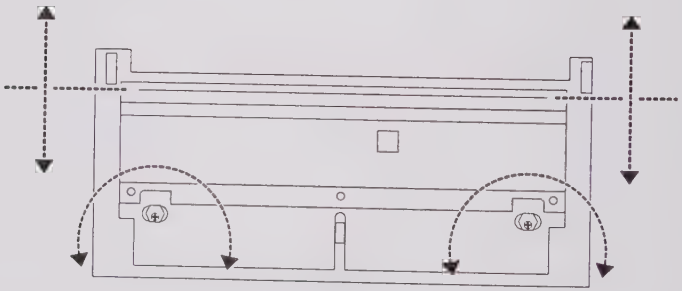
14 Hold the printhead plate in place against the underside of the paper chamber door keeping the springs under pressure.

15 Insert and slightly tighten the two Phillips-head screws that secure the printhead plate to the paper-chamber door.

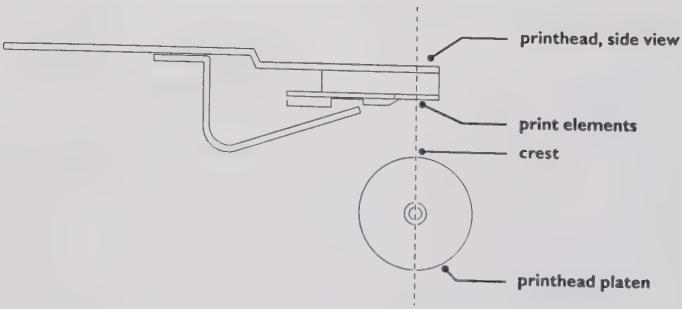
Replacing or adjusting the printhead

16 Horizontally align the thermal print elements of the new printhead with the crest of the printhead platen.

- Tighten or loosen the two Phillips-head screws and eccentric nuts that secure the printhead plate to the underside of the paper-chamber door.
- As the screws are adjusted, the movement of the eccentric nuts affects the alignment of the thermal printing elements.



- As shown below, "aligning the printhead" means horizontally adjusting the hairline row of print elements along the crest of the printhead platen.



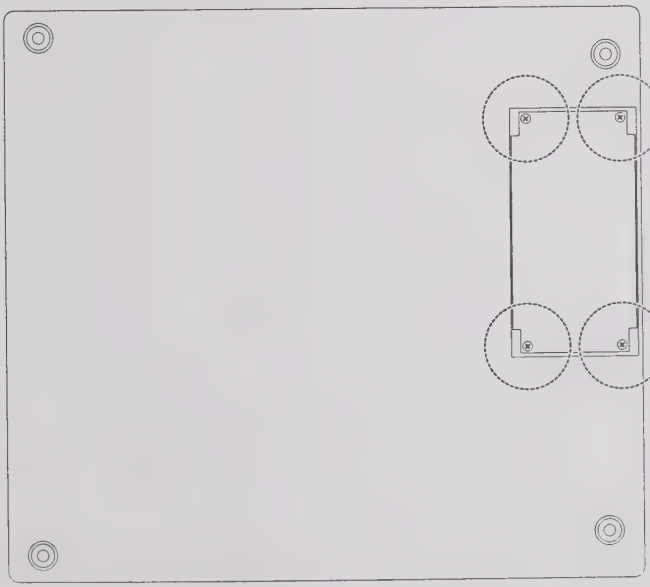
Replacing a battery pack

1 Turn off and unplug the DASH 10.

2 Turn the recorder bottom up.

3 Remove the four Phillips-head screws that secure the battery retaining plate.

- Set the screws and the retaining plate aside.

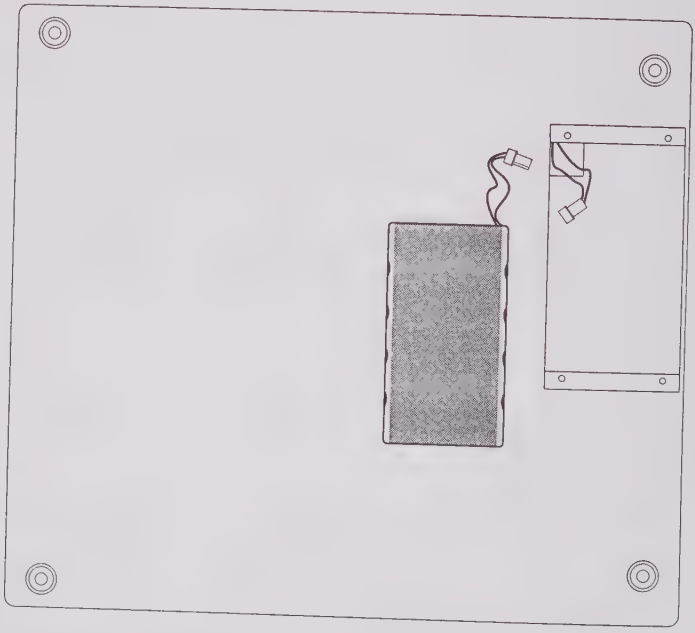


4 Remove the battery from the open compartment.

5 Unplug the connector that runs from the battery and attaches the battery to an internal harness.

- Set the old battery aside.
- See the illustration on the next page.

Replacing a battery pack

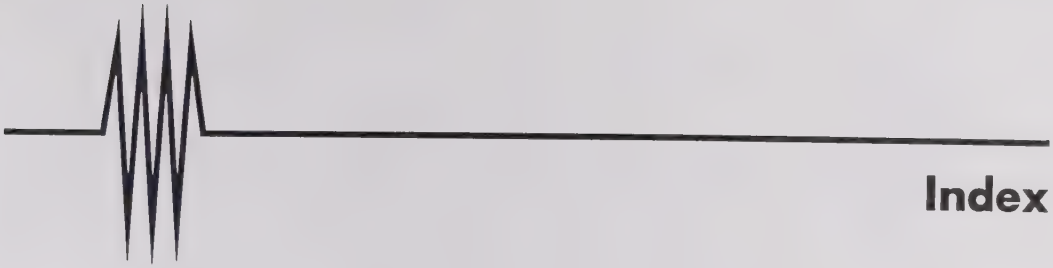


6 Plug the new battery pack into the battery connector.

7 Place the connected battery pack into the battery compartment.

8 Position the battery cover plate over the battery pack and secure the plate with the four screws removed in step 3.

■ This completes the battery replacement procedure.



Index

Index

A

AC requirement 1-5
A/D converters 1-4
addresses, GPIB 11-5
adjusting or replacing the printhead 15-5 - 15-10
A/D resolution 1-4
alphanumeric numeric keypad 1-3
amplitude resolution 1-1
analog settings, change all with MASTER CHANNEL 6-15
ANALOG STATUS parameter 14-1, 14-6
ANALOG STATUS report 14-8
AND/OR trigger groups 7-1 - 7-4
analysis, Fourier, performing on selected data 9-25 - 9-29
annotation, adding text to the chart 5-1 - 5-9
annotation, channel 1-4
annotation, on-demand 1-4
annotation, signal conditioner 1-4
annotation units 1-4
ARCHIVE RECORD parameter 8-22 - 8-28
archiving data-capture records to diskette 8-22 - 8-28
ASCII files, printing from diskette 10-11, 10-12
AUTO ID function 5-6
AUTO ID parameter 5-9
autotriggers 8-12, 8-16 - 8-18

B

background capture 1-6
battery pack, replacing 15-11, 15-12
baseline drift with temperature 1-2
baseline drift with time 1-2
baseline, zero, positioning 6-7, 6-8
battery 1-7
batter charge time 1-7
battery life 1-7
baud rates 11-4
boards, data-capture, linking multiple 8-19, 8-20
BRD parameter 8-5
BUFFER STATUS parameter 14-1, 14-6
BUFFER STATUS report 14-7
buffers, text, enabling or suppressing 5-2
buffers, text, positioning on the chart 5-4, 5-5

calibrating individual channels to voltage references 6-13, 6-4
CAL parameter 6-2, 6-3, 6-13, 6-14
capture, background 1-6
CAPTURE CONTROL parameter 8-5
capture, data 8-1 - 8-32
capture, data, about 8-1 - 8-4
capture header 1-7
capture memory 1-6
capture method, selecting 8-14 - 8-18
capture record sizes 1-6
capture sample rates 1-6
capture stacking 1-6
CAPTURE STATUS parameter 14-1, 14-6
CAPTURE STATUS report 14-10
capture time stamping 1-6
center triggers 8-12
CHANGE EVENTS 4-3, 4-13 - 4-15
CHANGE GRID 4-1, 4-2, 4-4 - 4-8
CHANGE T-MARKS 4-3
CHANGE WAVE 4-3, 4-9 - 4-12
changing fuses/line-voltage setting 13-1 - 13-3
channel annotation 1-4
channel ID 1-4
channel ID numbers, printing 5-6 - 5-8
channels, analog waveform, number of 1-1
CHANNEL STATUS parameter 14-1, 14-2, 14-5
channels, waveform, grounding 6-6, 6-7
charge time, battery 1-7
chart format, selecting for playback 9-11 - 9-13
chart layout, selecting a default 4-18, 4-19
CHART NAME 4-4, 4-16
charts, default, selecting 4-18, 4-19
chart sensitivity and signal adjustment 6-1 - 6-15
chart speed, controlling 3-1
chart speed, data-logger recording, setting 3-5
chart speed keys 1-3
chart speed, using fixed-speed keys to select 3-1, 3-2
chart speed, using the insta-speed keys to select 3-2
chart speed, using the [SPD] key to set 3-4
chart width 1-1
cleaning, printhead 15-3 - 15-5
clock, system, setting 11-3
CMRR 1-2
CMV (IMV), maximum 1-2
compressing or expanding a playback 9-9 - 9-11
continuous capture w/playback 8-2, 8-14

DATA CAPTURE RECORD ANALYSIS 9-23, 9-24, 9-28, 9-29
DATA ANALYZE parameter 9-21 - 9-23
data capture 1-6, 8-1 - 8-32
data capture, about 8-1 - 8-4
data-capture boards, linking multiple 8-19, 8-20
data, captured, plotting to select for FFT 9-22 - 9-24
data-capture method, selecting 8-14 - 8-18
data-capture playback 9-1 - 9-29
data-capture playback destination, selecting 9-17, 9-18
data-capture records, archiving to diskette 8-22 - 8-28
data-capture records, deleting 8-28 - 8-30
data-capture records, plotting as fast Fourier transforms 9-20 - 9-29
data-capture record, selecting for playback 9-4, 9-5
data-capture record size, selecting 8-10, 8-11
data-capture records, restoring from diskette 8-30 - 8-32
data capture requirements 8-2
data capture sample rate, selecting 8-8, 8-9
data capture, selecting entire record or specific part 9-4 - 9-7
data capture setups 8-3 - 8-32
data capture window and trigger placement 8-11 - 8-14
data logger 1-4
data logger recording, setting chart speed 3-5
data playback 9-1 - 9-29
data playback menu flow 9-3
DATA PLAYBCK parameter 9-1 - 9-29
DC/GND parameter 6-2, 6-3, 6-7, 6-8
DC requirement 1-5
DEFAULT CHARTS parameter 4-19
DEFAULT TEXT parameter 4-17
DELETE FILE parameter 10-9
DELETE RECORD parameter 8-28 - 8-30
deleting data-capture records 8-28 - 8-30
deleting files from diskette 10-9
destination, playback, selecting 9-17, 9-18
differential input, maximum 1-2
dimensions, overall 1-6
disk drive 1-3, 10-1
diskette, archiving data-capture records to 8-22 - 8-28
diskette-based input/output 10-1 - 10-12
diskette, deleting files from 10-9
diskette, input/output 10-1 - 10-12
diskette, printing ASCII files from 10-11, 10-12

D

diskette, recalling a recorder setup from 10-5, 10-6
diskette, renaming files on 10-7, 10-8
diskette, saving a recorder setup to 10-4, 10-5
diskettes, formatting 10-10, 10-11
DISK I/O menu flow 10-2
door release, paper chamber QS-2
DUAL SPEED menu flow 12-2
dual speed recording 12-1 - 12-10
dual speed recording, timed and triggered 12-1
dual-speed recording, timed, setting up 12-1 - 12-6
dual-speed recording, triggered, setting up 12-7 - 12-10

E

editing text buffers 5-2 - 5-4
[EDIT] key 5-1 - 5-7
ENABLE / DISABLE parameter 8-6
encoder wheel 1-3
end triggers 8-11
engineering units, converting voltage data to 6-10 - 6-13
EOI parameter 11-6
error messages 14-13 - 14-18
error messages, analog board errors 14-17
error messages, calibration errors 14-16
error messages, floppy disk drive errors 14-15
error messages, general system errors 14-15
error messages, hardware power on 14-14
event channels 1-1
event mark, manual 1-5
event markers, enabling; selecting chart location 4-13, 4-14
event marker style, selecting a global 4-14, 4-15
event marks, external 1-5
[EVNT] key, using 14-11
expanding or compressing a playback 9-9 - 9-11
external motor-clock source, referencing 3-6, 3-7
EXTERNAL trigger parameter 7-1

F

fast Fourier transforms, plotting data-capture records as 9-20 - 9-29
[FEED] key, using 14-11
FFT PLOT parameter 9-25
FFTs 9-20 - 9-29
files, ASCII, printing from diskette 10-11, 10-12
files, deleting from diskette 10-9
files, renaming on diskette 10-7, 10-8
FILL TYPE parameter 9-16
FILTER parameter 6-2, 6-3
filter, low-pass 1-2
filter, low-pass, using 6-10
fixed-speed keys, using to select chart speed 3-1, 3-2
FORMAT DISK parameter 10-10, 10-11
formats, user-defined 1-3
formatting diskettes 10-10, 10-11
Fourier analysis, performing on selected data 9-25 - 9-29
Fourier transforms, fast, plotting data-capture records as 9-20 - 9-29
FREQ RANGE parameter 9-27
frequency response 1-1
front-panel features 2-1, 2-2
fuse block QS-1
fuses/line-voltage setting, changing 15-1 - 15-3

G

GENERAL HELP parameter 14-1, 14-2
GENERAL HELP status report 14-3
GPIB interface, setting up 11-5, 11-6
grid change, specifying layout and location 4-5, 4-6
grid divisions, major/minor 4-5, 4-6
grid lines, horizontal 1-5
grids, custom, setting up 4-1 - 4-19
grid sensitivity and signal adjustment 6-1 - 6-15
grid setups, accessing 4-1
grid sizes 1-1
grounding individual waveform channels 6-6, 6-7

H

hardware features 2-1 - 2-5
[HELP] key, using 14-1 - 14-10
host interfaces 1-3
host trigger 1-7
HOST trigger parameter 7-1 - 7-4
humidity, relative 1-5
H/W parameter 11-4, 11-5

I

ID, AUTO function 5-6
ID, channel 1-4
ID, front-panel key 5-6
ID numbers, channel, printing 5-6 - 5-9
impedance, input 1-2
indicators 1-3
input connector, user 1-2
input, differential, maximum 1-2
input coupling 1-2
input impedance 1-2
input/output, system 11-1 - 11-8
input/output using diskettes 10-1 - 10-12
input type 1-2
insta-speed keys, programming 3-3, 3-4
insta-speed keys, using to select chart speed 3-2
intervals, time mark 1-5

K

keypad, alphanumeric 1-3
keys, insta-speed, programming 3-3, 3-4
keys, insta-speed, using to select chart speed 3-2
key, [SPD], using to set chart speed 3-4

L

LAYOUT GRIDS 4-5
LF/EOI parameter 11-6
line-voltage/fuses, changing 13-1 - 13-3
LINK parameter 8-6, 8-19, 8-20
linking multiple data-capture boards 8-19, 8-20
line printer 1-3
LOCATION parameter 4-14
log, system 1-4
low-pass filter 1-2
low-pass filter, using 6-10

M

maintenance 15-1 - 15-11
major / minor grid divisions 4-5, 4-6
manual event mark 1-5
manual trigger 1-7
marks, timing, tri-state 1-5
MANUAL trigger parameter 7-1 - 7-4
MASTER CHANNEL parameter 6-3, 6-4, 6-15
maximum CMV (IMV) 1-2
maximum differential input 1-2
maximum intrinsic noise 1-2
memory, capture 1-6
miscellaneous recorder functions 14-1 - 14-18
[MODE] key 9-1
MODE parameter 6-2, 6-3, 6-6
MODIFY CHART setups 4-1 - 4-19
MODIFY FILENAME parameter 8-22, 8-27
MODIFY WINDOW parameter 8-22, 8-25, 8-26, 9-2, 9-5 - 9-7
monitor refresh rate 1-3
monitor resolution 1-3
monitor type 1-3
motor-clock source, external, referencing 3-6, 3-7
multi-capture (stacking) 8-1, 8-13, 8-18

N

noise, intrinsic, maximum 1-2
non-linearity 1-2
numeric reporting 6-10 - 6-13

O

on-demand annotation 1-4
on-demand text buffer, printing 5-5, 5-6
operating temperature 1-5
OR trigger groups 7-4 - 7-7

P, Q

pack, battery, replacing 15-11, 15-12
PAGE EJECT function, using 14-12, 14-13
paper capacity 1-1
PEN parameter 4-9
percentage triggers 8-12
periodic trigger 1-7
PERIODIC trigger parameter 7-1 - 7-4, 7-11, 7-12
periodic trigger, setting up 7-11, 7-12
pin table, remote D-shell connector 2-4
pin table, RS232 D-shell connector 2-4
pin table, UTILITY D-shell connector 2-5
playback, chart format, selecting 9-11 - 9-13
playback, data 9-1 - 9-29
playback destination, selecting 9-17, 9-18
playback, expanding or compressing 9-9 - 9-11
playback, running the 9-18, 9-19
PLOT TYPE parameter 9-15
plot, XY, setting up 9-14 - 9-17
power input receptacle 15-1
power options 1-5
print elements, hairline row 15-5
PRINT FILE parameter 10-11, 10-12
printhead cleaning 15-3 - 15-5
printhead plate 15-6
printhead, replacing or adjusting 15-5 - 15-10
printhead retainer 15-7
printhead screws 15-8
printhead springs 15-9
Quick Start QS-1 - QS-4

range 1-2
RANGE parameter 6-2, 6-3, 6-5
range, voltage, setting 6-4, 6-5
real-time recording, standard 1-3
rear-panel features 2-3 - 2-5
RECALL SETUP parameter 10-5, 10-6
recorder functions, miscellaneous 14-1 - 14-18
recorder setup, recalling from diskette 10-5, 10-6
recorder setup, saving to diskette 10-4, 10-5
recorder setup, settings that make up 10-3
recording method 1-1
records, data-capture, archiving to diskette 8-22 - 8-28
records, data-capture, deleting from data-capture memory 8-28 - 8-30
records, data-capture, plotting as fast Fourier transforms 9-20 - 9-29
records, data-capture, selecting entire or specific part 9-5 - 9-7
records, data-capture, selecting for playback 9-4, 9-5
RECORD SIZE parameter 8-5
record size, data-capture, selecting 8-10, 8-11
record sizes, capture 1-6
RECORD STATUS parameter 8-6, 8-23
reference values, trigger, setting 7-8 - 7-11
references, voltage, calibrating with 6-13, 6-14
relative humidity 1-5
remote D-shell 3-6
remote D-shell connector, pin table 2-4
remote start/stop 1-3
RENAME FILE setup 10-7, 10-8
renaming files on diskette 10-7, 10-8
replacing a battery pack 15-11, 15-12
replacing or adjusting, printhead 15-5 - 15-10
REPORT parameter 4-10, 4-11, 9-2
RESTORE RECORD parameter 8-30 - 8-32
restoring data-capture records from diskette 8-30 - 8-32
RMS 1-2
RMS bandwidth 1-1
RMS recording mode, selecting 6-6
RS232 interface, setting up 11-4, 11-5
RS232 D-shell connector pin table 2-4
[RUN/HALT] key, using 14-11
RUN PLAYBCK parameter 9-19
running the playback 9-18, 9-19

sample rate 1-2
sample rate, data capture, selecting 8-8, 8-9
SAMPLE RATE parameter 8-5, 8-9
sample rates, capture 1-6, 8-2
SAVE SETUP parameter 10-3, 10-5
saving a recorder setup to diskette 10-4, 10-5
sensitivity, chart 6-1 - 6-15
SET CHANNEL parameter 8-22, 8-25
SET DEVICE parameter 9-2, 9-17, 9-18
SET FORMAT parameter 9-2
SET MAGNIF parameter 9-2, 9-9 - 9-11
SET RECORD parameter 8-22, 8-24, 9-2, 9-5
SET XY-PLOT parameter 9-2
SETUP ARCHIVE parameter 8-24
SETUP CAPTURE parameter 8-3 - 8-32
SETUP CHART parameter 12-6, 12-10
SETUP DURATION parameter 12-5, 12-9
SETUP GPIB parameter 11-5, 11-6
SETUP PERIOD parameter 7-11, 7-12
SETUP PLAYBCK parameter 9-1 - 9-29
setup, recorder, settings that make a 10-3
SETUP RS232 parameter 11-4, 11-5
setups, data capture 8-3 - 8-32
SETUP SPEEDS parameter 12-4, 12-7
SETUP TRIGGER parameter 7-1 - 7-12
SETUP WAVE parameter 7-4 - 7-7
signal adjustment and chart sensitivity 6-1 - 6-15
signal conditioner annotation 1-4
signal conditioner reporting, enabling or suppressing 4-10, 4-11
signal filter, low-pass, using 6-10
signal input connectors, front-panel QS-4
single capture 8-1, 8-16, 8-17
single capture w/playback 8-1, 8-13, 8-17
software, system upgrade, performing 11-6, 11-7
specifications 1-1 - 1-7
[SPD] key, using to set chart speed 3-4
speed accuracy 1-1
speed controls 3-1 - 3-7
speed keys, chart 1-3
speed keys, fixed, using to select chart speed 3-1, 3-2
speed keys, insta, using to select chart speed 3-2
speeds 1-1
stacking, capture 1-6
stacking, multi-capture 8-1, 8-13, 8-18
start/stop, remote 1-3

S

start triggers 8-11
storage temperature 1-5
STYLE parameter 4-15
suppression, zero, applying to waveform signals 6-9
synchronizing grids to trilevel timing marks 4-8
system clock, setting 11-3
SYSTEM CLOCK parameter 11-3
system input/output 11-1 - 11-8
SYSTEM I/O menu flow 11-2
system log 1-4
system software upgrade, performing 11-6, 11-7
SYSTEM STATUS parameter 14-1, 14-2
SYSTEM STATUS report 14-4
SYSTEM UPGRADE parameter 11-6, 11-7

T

temperature, operating 1-5
temperature, storage 1-5
text, adding to the chart 5-1 - 5-9
text buffer, on-demand, printing 5-5, 5-6
text buffers, editing 5-2 - 5-4
text buffers, enabling or suppressing 5-2
text, default, printing in buffers 4-17
thickening the appearance of the waveform 4-11, 4-12
time base resolution 1-1
time bases, playback 8-2
timed and triggered dual speed recording 12-1
timed dual-speed recording, setting up 12-1 - 12-6
timed recording 1-4
TIMER START parameter 13-1
TIMER START recording mode, setting up 13-1 - 13-3
TIMER START recording mode, starting immediately 13-4
TIMER START recording mode, using 13-1 - 13-4
time stamping, capture 1-6
timing mark intervals 1-5
timing marks, trilevel, synchronizing grid to 4-8
timing marks, tri-state 1-5
TOP-OF-FORM capability, using 14-12
TRACE parameter 4-11, 4-12
triggered and timed dual speed recording 12-1
triggered dual-speed recording, setting up 12-7 - 12-10
trigger, host 1-7

T

triggering capabilities 7-2, 7-3
trigger, manual 1-7
trigger, periodic 1-7
trigger, periodic, setting up 7-11, 7-12
trigger placement and data-capture window 8-11 - 8-14
TRIGGER POSITION parameter 8-5, 8-13
trigger reference values, setting 7-8 - 7-11
trigger sources, combining into trigger groups 7-4 - 7-7
trigger sources, turning on 7-3, 7-4
triggers, setting up and enabling 7-1 - 7-12
TRIGGER STATUS parameter 14-1, 14-6
TRIGGER STATUS report 14-9
trigger, waveform 1-7

U

upgrade, system software, performing 11-6, 11-7
user-defined formats 1-3
UNITS parameter 8-26, 9-8, 9-27
USER SCALING parameter 6-3, 6-4, 6-10 - 6-13
UTILITY D-shell connector pin table 2-5

V

voltage data, converting to engineering units 6-10 - 6-13
voltage range, selecting 6-4, 6-5
voltage references, calibrating individual channels with 6-13, 6-14
voltage selection box QS-1, 15-1
voltage selection cylinder QS-1, 15-2, 15-3

W

WAVE AND group 7-5
waveform channels, grounding individual 6-6, 6-7
waveform data, plotting to select for FFT 9-22 - 9-24
waveform format 1-3
waveform input plot 9-24
waveform size, maximum 1-1
waveforms, suppressing or enabling printing of 4-9
waveform, thickening the appearance of 4-11, 4-12
waveform trigger 1-7
WAVE OR group 7-5
WAVE trigger parameter 7-1 - 7-4
weight 1-6

X

XON/XOFF parameter 11-4, 11-5
XY plot, setting up 9-14 - 9-17
XYY plot type 9-15, 9-16

Z

zero and gain controls 6-2, 6-3
zero baseline positioning 6-7, 6-8
ZERO parameter 6-2, 6-3
zero suppression 1-2
zero suppression, applying to waveform signals 6-9
ZOOM FACTOR parameter 9-26
ZS parameter 6-3, 6-9